LEVEL II

ARPA ORDER NO.: 189-1
7D20 Cybernetics Technology

12

R-2152-ARPA
October 1977

First-Term Reenlistment Intentions of Avionics Technicians: A Quantitative Analysis

Wayne D. Perry

A Report prepared for

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Rand
SANTA MONICA, CA. 90406

The research described in this report was sponsored by the Defense Advanced Research Projects Agency under Contract No. DAHC15-73-C-0181.

Library of Congress Cataloging in Publication Data

Perry, Wayne DeRoyce,
First-term reenlistment intentions of Air Force avionics technicians.

([Report] - Rand Corporation ; R-2152-ARPA)
Includes bibliographical references.
1. United States. Air Force--Recruiting, enlistment, etc. 2. United States. Air Force--Personnel management. 3. United States. Air Force--Aviation electronics technicians. I. United States. Defense Advanced Research Projects Agency. II. Title. III. Series: Rand Corporation. Rand report ; R-2152-ARPA.
AS36.R3 R-2152 [UG883] 081s [358.4'12'2] 78-16904
ISBN 0-8330-0015-2

Published by The Rand Corporation

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER R-2152-ARPA	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) First-Term Reenlistment Intentions of Avionics Technicians: A Quantitative Analysis		5. TYPE OF REPORT & PERIOD COVERED Interim 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) W. D. Perry		8. CONTRACT OR GRANT NUMBER(s) DAHC15-73-C-0181
9. PERFORMING ORGANIZATION NAME AND ADDRESS The Rand Corporation 1700 Main Street Santa Monica, Ca. 90406		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Defense Advanced Research Projects Agency Department of Defense Arlington, Va. 22209		12. REPORT DATE October 1977 13. NUMBER OF PAGES 99
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release; distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

No restrictions

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Avionics
Recruiting
Military Personnel
Manpower

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

see reverse side

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Focusing on a highly skilled field with acute manpower shortages, the author analyzes first-term reenlistment-intent responses from a survey sample of Air Force electronics technicians to develop an understanding of the factors affecting an individual's propensity to reenlist in or withdraw from military service. The military reenlistment decision is hypothesized as a continuous process during the enlistee's first term. The study provides a general statistical approach for determining a small set of key factors that explain and predict first-term reenlistment intentions. The author employs a range of methodologies, some not normally applied to manpower problems, including principal components, regression, discriminant, and logistic analyses. The results center on six key explanatory factors: (1) the military career intentions at initial enlistment; (2) job satisfaction; (3) marital status; (4) economic incentives; (5) length of service; (6) desire to supervise others. Based on these findings, manpower policies are recommended for increasing the retention of skilled technicians during and at the end of the first term. 99 pp. Refs. (DGS)

(14) RAND / R-2152-ARPA

(11) Oct[redacted]77

(9) Interim rept.,

(6)

First-Term Reenlistment Intentions of Avionics Technicians: A Quantitative Analysis.

(10) Wayne D./Perry

(12) 141 p.

(15) DAHC15-73-C-0181,
A Report prepared for ARPA Order-189

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

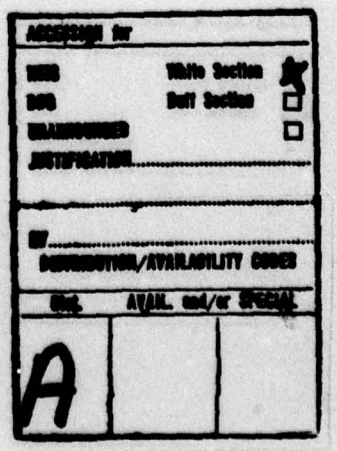
Rand
SANTA MONICA, CA. 90406

PREFACE

This report was prepared as part of Rand's Defense Manpower Studies Program sponsored by the DoD's Human Resources Research Office of the Defense Advanced Research Projects Agency (ARPA). With manpower issues assuming an ever greater importance in defense planning and budgeting, the purpose of this research program is to develop broad strategies and specific solutions for dealing with present and future military manpower problems. The program includes the development of new research methodologies for examining broad classes of manpower problems, as well as specific problem-oriented research. In addition to providing analysis of current and future manpower issues, it is hoped that this research program will contribute to a better general understanding of the manpower problems confronting the Department of Defense.

A shortage of career military personnel persists in certain skilled occupations. Avionics technicians represent a highly skilled electronic maintenance career field with acute shortages. The author of the present report performed exploratory empirical research on a sample of Air Force avionics technicians to develop an understanding of some key factors explaining their first-term reenlistment intentions. Using the empirical findings, he recommends manpower policies for increasing the retention of these skilled technicians during and at the end of the first term.

Implicit in this effort is the objective of improving the modeling of the military reenlistment decision process. This study provides a quantitative approach to the problem of predicting and understanding changes in the propensity of skilled military personnel to reenlist at the end of the first term.



SUMMARY

Any individual's decision to reenlist in or withdraw from military service must necessarily emerge from a complex decisionmaking process. In this study, the decision to reenlist is hypothesized as a continuing process throughout the first term of an individual's military service. The basis for this hypothesis is derived from a synthesis of traditional economic and behavioral approaches to the analysis of reenlistment and from previous empirical studies of reenlistment behavior.

Measuring, empirically, an *individual's* continually changing propensity to reenlist presents a number of operational difficulties. The Enlisted Utilization Survey questionnaire administered by Rand's OSD Manpower Studies Program provided individual responses to questions relating to the perceptions and attitudes of avionics technicians (Air Force Specialty (AFS)-326) concerning initial military career plans and reenlistment intent *up to midway* during their first term. This cross-sectional survey was conducted in FY74 primarily to generate a data base for studying the effects of military training on productivity. Consequently, most of the avionics technicians sampled (96 percent) were on their first duty station and 94 percent of the sample had at most 2 years of service. Only 6 percent of them stated that they definitely intended to reenlist. It was observed that, on average, the avionics technicians' propensity to reenlist significantly and uniformly declined with increased length of service. Therefore, one must proceed cautiously in attempting to extrapolate from the empirical findings of this survey *predictions* of *actual* future reenlistment behavior.

The survey instrument does provide a tool for measuring the individual's length of military service and for determining his attitudes toward Air Force organizational policies and practices, both economic and noneconomic, with those he perceives to exist in civilian employment. Data on personal background and demographic characteristics were also collected for each individual in the sample. The data base contains a large number of plausible explanatory variables relating to the first-term reenlistment intentions of avionics technicians. Hence, an opportunity exists for determining, well before the end of the first

term, what factors exert the most influence on a technician's propensity to withdraw from military service.

METHODOLOGICAL OVERVIEW

Many of the explanatory factors hypothesized proved to be interrelated and thus could be represented by a single questionnaire item or by a simple grouping of items. First, principal components factor analysis was used to reduce the data base to a manageable set of intuitively and conceptually appealing variables influencing the individual's reenlistment intent. Next, interactive regression techniques were applied, with the stated reenlistment intent as the dependent variable. Of equal importance for a quantitative policy analysis of this decision process is the fact that the central response of concern, reenlistment intent, is qualitative. The questionnaire response choices for the first-term reenlistment-intent question were: "Yes"; "Undecided, but probably Yes"; "Undecided, but probably No"; and "No." This categorized reenlistment-intent question permits one to divide the sample into four response groups, and discriminant analysis provides an appropriate tool for deriving a set of explanatory factors and dimensions in the data that best distinguish each group.

An interesting and somewhat encouraging result was that the discriminant analysis identified essentially the *same* set of key distinguishing variables as did the more standard regression approach. This result suggests that an ordinal dependent variable measuring reenlistment intent in a regression analysis can yield important insights into a technician's withdrawal intentions. However, the discriminant analysis shows that a *single* equation or dimension based on a linear combination of the variables is *not* adequate to model, for policy or explanatory purposes, the qualitative measure of reenlistment intentions. Therefore, a logistic analysis was performed to provide explicit policy insights that were conditional on *each* explanatory variable associated with *each* group of respondents. Using the key factors determined by the regression and discriminant models, the estimated logistic models tended to confirm and reinforce the previous interpretations associated with the explanatory factors. This

encouraging result increased the level of confidence and also refined the policy implications of the empirical findings.

MAJOR EMPIRICAL FINDINGS

The use of a range of statistical methodologies, some not normally applied to manpower problems, produced empirical results that tended to converge and to support many previous theoretical and intuitive conceptualizations of military turnover, as well as other studies of reenlistment intent. These results relate to the avionics technician's reenlistment intentions *up to midway* during his first term of military service and center on six key explanatory or discriminating factors.

The most important factor contributing to the technician's reenlistment plans is his *military career intentions at the time of his enlistment in the Air Force*. The second most important factor is his *military job satisfaction* (in terms of tasks, training opportunities, and personal freedom), as compared with perceived civilian employment opportunities. *Marital status* was the only important background attribute among the major discriminating variables. The other key factors pertain to Air Force *economic incentives* compared with perceived civilian opportunities. The military fringe benefits package (medical, housing, and retirement) and direct wages were of almost equal importance in influencing reenlistment intentions. Another key factor was the technician's *length of service*, as measured by the number of months that he had been at the first duty station. Having only a few months of actual on-the-job experience contributes significantly to an individual's indecision about reenlistment. This finding supports the hypothesis that the decision to reenlist is a dynamic process. Finally, assuming equal pay for nonsupervisors, a technician's *desire not to supervise others* appears to contribute substantially to the likelihood of his being undecided but *not* favorable toward reenlistment.

MANPOWER POLICY RECOMMENDATIONS

Positive initial career motivation has a dominant influence on affirmative first-term reenlistment intentions of avionics technicians. *Improved recruitment and selection procedures, as well as studies aimed*

at identifying the characteristics and causes of favorable initial military career intentions, should increase the first-term reenlistment of avionics technicians. The All-Volunteer Force should, in the long run, provide a greater number of persons who enlist in the Air Force with positive career motivations. Of course, these two recommendations are contingent on *equity* and *quality* considerations, as well as on the *quantity*, or manpower levels, of career avionics technicians desired.

Given that the influence of initial military career intentions is mitigated over time, and that job satisfaction has a significant effect on reenlistment intent, the avionics technician's propensity to reenlist can be altered by his on-the-job opportunities and experiences. *Policies and practices that provide prospective and new recruits with adequate and accurate information about Air Force life, training opportunities and their future applications, and the job content of the various occupational specialties available should prove valuable.* The individual would then have a more realistic expectation of Air Force service, which should improve the probability of his first-term reenlistment and lessen the possibility of his withdrawal at any time during his first term of service.

The Air Force's rigid career path policy that requires virtually all career avionics technicians to become supervisors is apparently having an adverse effect on first-term reenlistment intentions. This finding gives tentative support to the notion that avionics technicians should have the opportunity of choosing to remain skilled tradesmen rather than being forced to assume management responsibilities near or at the end of their first term of service. *The advantages of a dual career path should be assessed in terms of its cost and the net increase in the number of retained avionics technicians.*

The insignificant effect of certain individual background, demographic, or screening variables on reenlistment intent was an unanticipated but not too surprising finding, given the homogeneity of the personnel engaged in this highly screened maintenance field. Avionics technicians all have uniformly high Armed Forces Qualification Test (AFQT) scores, aptitudes, and educational levels. Also, a negligible

number of minorities and women are selected for this specialty (less than 5 percent). Furthermore, one may conjecture, based on empirical evidence from other studies, that most of the impact of the technician's personal background is captured by his initial military career motivation, which is related significantly to his first-term reenlistment intentions.

Economic incentives have long been recognized as defense manpower policy variables that can be used to improve the first-term reenlistment rates. *This study supports the importance of direct wages and the total Air Force fringe benefits package as inducements to increased reenlistment intentions of avionics technicians when they perceive them as being equal to or greater than those provided by civilian opportunities.* However, if the costs associated with various economic rewards are too high, this study suggests that alternative strategies can be used to increase the supply of career avionics technicians in the Air Force. That is, the manpower policy recommendations given above for improving reenlistment intentions indicate the importance of (a) determining the selection and screening criteria that will better identify levels of initial military career motivations; (b) providing new recruits with occupational counseling and adequate and accurate information about Air Force service in general and the avionics maintenance field in particular; and (c) enhancing job satisfaction by increasing individual personal freedom and relaxing Air Force career path rigidity so that not all career avionics technicians are required to become supervisors.

ACKNOWLEDGMENTS

I would like especially to thank Rand colleagues Richard V. L. Cooper and David S. C. Chu, and former colleague Bernard D. Rostker, for their valuable suggestions for improving earlier drafts of this report. Also, Robert Gay's guidance at the beginning of the research effort, Gus Haggstrom's statistical insights, Patricia Gowen's computer assistance, and Barry Fishman's programming information are gratefully acknowledged. The two reviewers, Frank A. Camm, Jr. and Anthony H. Pascal, provided essential comments for the final presentation of this research. Finally, I appreciate Donna Sloat's excellent secretarial skills. Of course, I am solely responsible for any remaining errors or omissions.

CONTENTS

FIGURES

TABLES

I. INTRODUCTION

THE DEFENSE MANPOWER PROBLEM

A chronically small supply and a consistently high demand persists for career military manpower in certain skilled occupations. This condition is due, in part, to the "closed" military personnel system; i.e., enlisted personnel can only enter skilled specialties as new recruits at the beginning of their first term of obligated service. Consequently, as a result of negative reenlistment decisions, the supply of valuable, trained, experienced career personnel is much smaller than the unskilled pool of new recruits.

The greatest losses usually occur at the end of the first term. Higher turnover rates of the more highly skilled enlisted personnel also increase the costs of this already expensive group. The military services are losing a substantial part of their initial training investment in these specialists because their productivity is realized later than that of unskilled personnel. In recent years, with the end of the draft and the general increase in defense manpower costs, first-term losses of skilled personnel have become of even greater concern.

The Air Force suffers an acute manpower problem due to an inadequate supply of career personnel in the most highly skilled specialties. As Table 1 shows, avionics technicians are a prime example of lower-than-desired first-term reenlistment in a highly skilled, career maintenance field. As a result, Air Force career manpower requirements for this maintenance field are much greater, based on expected work loads, than the anticipated supply. An objective of this study is to suggest policies that could help to solve this problem by providing insights into those factors that determine the first-term reenlistment intentions of avionics technicians in Air Force Specialty (AFS)-326.[1]

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[1]All aircraft avionics systems consist of electronic sensors, computational devices (analog and digital computers), and functional control and display units. The support of this equipment is divided into flightline (AFS-326X2) and ground shop personnel (AFS-326XO and 326X1) associated with the Air Force's traditional levels of maintenance--organizational, intermediate, and depot. For a detailed analysis of

Table 1

PROJECTED RETENTION RATES RELATIVE TO AIR FORCE MANPOWER REQUIREMENTS FOR SELECTED ELECTRONIC SPECIALTIES

Maintenance Specialty	*Percent Retention*
Weather equipment	29
Air traffic control	38
Radio relay equipment	19
Flight facility equipment	19
Ground radio communications equipment	8
Television equipment	10
Electronic computer systems	8
Missile systems analysis	15
Missile systems maintenance	24
Precision measuring equipment	17
Automatic flight control systems	12
Avionics instrument systems	21
Avionics aerospace ground equipment[a]	30
Integrated avionics components[a]	21
Integrated avionics systems[a]	12
Avionics communications	10
Avionics navigational systems	9
Avionics inertial/radar navigational systems	6
Avionics sensor systems	28

SOURCE: Department of Defense, Office of Manpower and Reserve Affairs' Projections for FY74.

[a]Avionics technicians, Air Force Specialty (AFS)-326, sample chosen for empirical analysis in this study.

PLAN OF THE REPORT

This report attempts to answer two questions:

1. *Substantive.* What perceptions of economic and noneconomic defense manpower policies and practices, controlling for individual backgrounds, affect the reenlistment intentions of skilled first-term personnel?

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the job content and training of this integrated maintenance career field, see Carpenter-Huffman and Rostker [4], Carpenter-Huffman, Neufer, and Rostker [5], and Duren [6].

2. *Methodological.* How can avionics technicians' stated reenlistment intentions be modeled statistically by a small set of key factors to derive Air Force manpower policy recommendations that will increase their career supply?

As a starting point for answering the substantive question, the various approaches to the study of military turnover are briefly reviewed in Section II. In particular, current economic and psychological approaches for studying occupational choice are surveyed to derive a conceptual and operational framework.

The military reenlistment decision is hypothesized to be a continuous process during the first term. Based on this hypothesis of emerging first-term military turnover, the difficulties associated with previous attempts to measure quantitatively an individual's reenlistment intentions during the first term are analyzed in Section II. This section also discusses previous empirical studies that combine economic and noneconomic approaches to determine, statistically, the key factors influencing first-term reenlistment intentions of military personnel.

Rand's Enlisted Utilization Survey questionnaire is examined in Section III as a data base for measuring the reenlistment intentions of AFS-326 avionics technicians. One must realize, however, that this survey was not conducted primarily to study first-term reenlistment intentions but to investigate the influence of military training on productivity. Section III also provides an overview of the statistical approach developed in this study to extract all the information in the survey data pertaining to reenlistment intentions. The statistical methodology used drew upon regression, discriminant, and logistic analyses.

In Section IV, the statistical approach is applied to ascertain how many key factors influenced the reenlistment intentions of the avionics technicians sampled in the Enlisted Utilization Survey. The findings explaining their reenlistment intentions up to midway in their first term tended to converge and centered on six key factors. These findings are compared with those of previous studies wherever appropriate.

The fundamental results of the study are summarized in Section V. Some implications of these results as they apply to manpower policies are also discussed in Section V, together with suggestions for future research.

II. PREVIOUS APPROACHES TO STUDYING THE PROBLEM OF MILITARY TURNOVER AND REENLISTMENT INTENTIONS

INTRODUCTION

Various disciplines have long been interested in studying the problem of labor turnover. Attacks on the problem range from establishing selection and screening criteria for hiring to investigating methods of inducing changes in an individual's withdrawal behavior after entering an internal labor market. The latter strategy can be separated into two broad approaches: (1) monetary incentives and (2) organizational modifications. The first approach, as viewed by traditional labor economists, concentrates on wages and other pecuniary benefits as the primary variables affecting turnover. The second approach involves a study of (a) the consequences of modifying the organizational climate to enhance job satisfaction and (b) other psychological factors that can influence an individual's propensity to leave.

To date, the theories and approaches that relate either directly or indirectly to an individual's withdrawal from an internal labor market are not sufficiently complete (and far too tentative) to specify an *exact functional* relationship for empirical testing. The specification of the model and the selection of the relevant explanatory and dependent variables are essentially an empirical problem. The strategy used should be based on (a) the relative explanatory power, (b) accuracy in predicting individual first-term reenlistment decisions, and (c) the potential for gaining manpower policy insights. This study will focus on *one* aspect of the total reenlistment decision process for defense manpower, first-term reenlistment intent. Studies at Rand and elsewhere have been investigating, and are continuing to investigate empirically and theoretically, the determinants of initial military career motivations and actual reenlistment decisions. This report should be viewed as complementary to these other studies.

The reader should remain aware throughout this study that it is concerned with reenlistment *intentions*, and not with actual reenlistment *decisions*. Much work in this area fails to make this distinction. Policymakers are ultimately interested in final reenlistment decisions, of course, but an understanding of intentions can also lead to a better understanding of the reasons behind a final reenlistment decision. However, stated intentions and actual behavior are not the same thing.

ECONOMIC APPROACH

Most studies of military labor supply have focused on the impact of economic factors (base pay, pro-pay, and bonus awards) thought to increase first-term reenlistment rates.[1] The sampling unit is usually a group of eligible enlistees having various specialties and a specific set of individual attributes.[2] The policy-oriented output of the econometric models has been elasticities that reflect the net increase in first-term reenlistment for these groups, given a percentage increase in some or all the monetary incentives. As an example, Enns [7] found

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[1]Base pay is regular military monthly earnings, including allotments for dependents but excluding any fringe-benefit payments for food, housing, or medical expenses. Proficiency pay (pro-pay) is used to increase retention and is offered to all reenlistees (first term and beyond) in designated "shortage specialties." It is disbursed as monthly increments to base pay.

Various types of lump and deferred first-term cash bonus awards have been offered. Up to FY75, the regular first-term reenlistment bonus was a lump sum paid to all specialties and consisted of 1 month's base pay for each year in the reenlistment term. Beginning in FY67, bonuses were offered for reenlistment in selected specialties experiencing retention problems. This bonus can be disbursed as a lump sum at the time of reenlistment or in annual installments over the reenlistment term. The variable reenlistment bonus (VRB) (FY67-FY75) assigned multiples of one to four for certain specialties, and the total award was the product of the multiple and the regular reenlistment bonus. Beginning in FY75, the selected reenlistment bonuses (SRB) replaced the VRB. Regular reenlistment bonuses would be eliminated after some period of time, and up to six multiple factors are now used for selected specialties to help improve first-term reenlistment rates. As a review of the economic approaches of studying military reenlistment behavior, see Enns [7], Foch [9], Lindsey and Causey [16], McCall and Wallace [20], Center for Naval Analyses [24], Nelson [25], Nelson and Wilburn [26].

[2]These attributes include Armed Forces Qualification Test (AFQT) scores, age, race, education, marital status, occupational category, etc.

the first-term reenlistment supply elasticity to be 3.4 with respect to the variable reenlistment bonus for the Air Force. This finding is greater than the supply elasticity of 2.36 based on aggregate Air Force pay reported by the Gates Commission study [25]. The so-called "improvement factor" is a similar measure of the effect of these compensation policies. This factor is the ratio of the *predicted* reenlistment rates with the given pecuniary incentive in effect to the *predicted* reenlistment rate in the absence of the incentive. All the studies surveyed consistently found that pecuniary reenlistment incentives do increase the supply of second-term Air Force personnel.

Implicit in these analyses is the traditional economic model of occupational choice. The model assumes that each individual performs a utility (or satisfaction) maximization based on a cost-benefit type analysis of the pecuniary and nonpecuniary aspects of the military service and his perceived opportunities in the civilian labor market. The eligible enlistee then determines the "reservation" wage or the military pay that will just make the cost-benefit ratios identical for military and civilian employment. At this point each individual is indifferent between the two sectors; any incremental pay above the reservation wage will induce his reenlistment.

Of course, an *individual's* reservation wage is not observable. The typical empirical approach is to group a sufficiently large sample of reenlistment decisions and then to model statistically the variance in the group's reenlistment rate for different levels of pecuniary incentives. The usual incentive has been in the form of first-term reenlistment bonus awards for certain specialties. The sample data are collected in the "natural" state; there have been no controlled experiments performed to assess the results of incremental wage changes on supply. Since no natural control group is used in these studies, the observed changes in reenlistment behavior may be primarily a result of other nonpecuniary factors.

NONECONOMIC APPROACH

Much behavioral research has been done in the past 15 years on the factors relating to voluntary turnover in the military and civilian

sectors (see Goodstadt and Glickman [11], Porter and Steers [29]). Generally, overall job satisfaction is found to be inversely related to turnover. This general concept of satisfaction or utility, while important, does not help one know *why* an individual is dissatisfied or *what* must be changed in an effort to retain him. Moreover, merely establishing the relationship between job satisfaction and turnover does not allow one to predict or estimate the probability of turnover *before* it occurs.

One psychological framework, developed to look behind job satisfaction, examines the discrepancy between an individual's expectation about an event and the way the event actually turns out.[3] This approach hypothesizes that turnover is related to this discrepancy. Studies of turnover have found there were no significant differences in expectations *at the time of entry* of workers who stayed and those who decided to leave (see Porter and Steers [29]). However, as length of time on the job increased, significant differences emerged. Those who remained felt that both the *content* and *context*[4] of the job generally met their original expectations, whereas those who left did not.

These results are consistent with studies that indicate that the frequency with which individuals think about leaving their jobs is related significantly to turnover (see Perry [28] and Porter and Steers [29]). For example, voluntary nonattendance, tardiness, absenteeism, and AWOL may be expressions of an intention to leave. In other words, lack of attendance represents the next rational decision in the process of withdrawal after the employee has experienced some form of dissatisfaction or disutility on the job. The decision of whether or not to reenlist evolves from a dynamic process in which expectations and results are continually compared and the discrepancy acted upon. The

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[3]This "met-expectations" framework was developed by Porter and Steers [29] and was based on the "expectancy/valence" theory of motivation in Vroom [34].

[4]Job "content" refers to the tasks and duties performed during the job's execution, i.e., training and aptitudes needed, say, to repair electronic equipment or to be a supervisor, etc. Job "context" implies organizational policies and climate, such as fringe benefits, pay and promotion, and supervisory policies and styles.

met-expectancy theory, then, provides insights into an employee's attitudes about continuing participation and hence into his intentions to reenlist.

PROBLEMS WITH AN INTEGRATED APPROACH

Nonpecuniary aspects governing the reenlistment decision include psychological factors, such as attitudes, perceptions, and motivations related to individual demographic and socioeconomic backgrounds, as well as experience with different organizational climates (including coworker and supervisory interaction). However, because of the lack of data on these individual variables, econometric studies usually have had to lump them into the error term or assume that they are homogeneous for specific groups. Psychological variables, such as perceptions and attitudes, *cannot* be assumed homogeneous within a group and are therefore excluded from the models relying on grouped data. Moreover, the psychological variables themselves have not been used as a basis for grouping, say, individuals with the same "amount" of motivation, because of the relatively high degree of measurement error associated with these variables. Thus, "economic" and "psychological" variables have not been considered jointly with samples of grouped data.

This lack of an integrated approach is as true in defense manpower research as in other areas. In the study of military turnover, there are several reasons for the absence of interdisciplinary research and the difficulty of achieving it. The costs of collecting individual survey data on the psychological factors influencing reenlistment behavior is usually prohibitive. Consequently, econometric models have relied on searches of existing records and files as a method of data collection. The influence of manpower policy manipulation on individual psychological factors has been considered very difficult or impossible to measure. Finally, disciplinary isolation exists among economists, behavioral and management scientists, and industrial relations researchers investigating employee withdrawal from internal labor markets. This lack of communication has hindered an interdisciplinary methodological or theoretical approach in the study of defense manpower supply.

A CONCEPTUAL FRAMEWORK FOR STUDYING MILITARY TURNOVER EMPIRICALLY

More interdisciplinary studies should be performed that disaggregate the concept of job satisfaction and perceived expectations into various components--psychological, economic, and individual--that are hypothesized to influence occupational choice. These components include both microfactors and macrofactors. The microfactors include: (1) organizational policies and characteristics, (2) coworker and supervisory interaction, (3) other job-related pecuniary and nonpecuniary attributes, and (4) personal background and individual and demographic characteristics (both psychological and socioeconomic). Macrofactors include overall economic conditions, specific job alternatives available to the individual, and family as well as public attitudes concerning military service. All of these factors are considered important explanatory variables related to an individual's reenlistment intentions. However, the macrofactors will be excluded from this study because emphasis here is on the individual's perceptions of Air Force organizational policies and practices, and because sufficient data were not available for empirical investigation.

The met-expectations theory suggests that the four microfactors, and an individual's perception of them, will interact continually during his military service. Figure 1 outlines some of the basic interactions in this process. This conceptual diagram suggests that an individual's propensity to reenlist can change continually with length of service during his first term. Initial military career motivation and expectations have been shown to be influenced by individual attributes (sex, age, race, marital and socioeconomic status, education, etc.) and civilian labor market perceptions or experiences (if applicable) (see Goodstadt and Glickman [11]). Once an individual chooses to enter military service, these motivations and expectations are continually altered or reinforced by actual job opportunities and experiences, which, of course, include both job context and content, as well as economic and noneconomic factors. Therefore, the propensity to reenlist will change as new information is accumulated and perceptions of relative civilian opportunities are updated. Initial military career intentions should continue to influence reenlistment

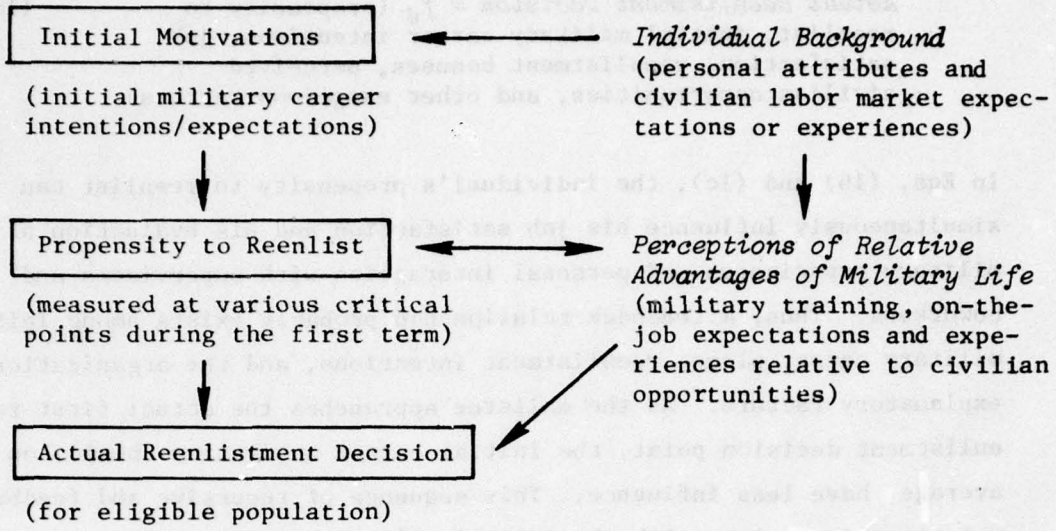

Fig. 1--A conceptual model of the first-term reenlistment decision

intentions significantly because of the recursive or emerging nature of the decision. That is, these initial career intentions provide a frame of reference within which to compare new information with previous experiences or perceptions of civilian opportunities.

The diagram in Fig. 1 suggests that a simultaneous system of equations is required to model completely the first-term reenlistment decision process. Preliminary structural forms of the system of equations may be expressed in the following manner:

$$\textit{Initial Military Career Intentions} = f_1 \text{ (individual attributes, socioeconomic background, civilian labor market experiences or expectations, and other exogenous factors)} \quad \text{(1a)}$$

$$\textit{Propensity to Reenlist} = f_2 \text{ (initial military career intentions, job satisfaction, length of service, economic incentives, perceived civilian opportunities, and other exogenous factors)} \quad \text{(1b)}$$

$$\textit{Job Satisfaction} = f_3 \text{ (military career intentions, job expectations, propensity to reenlist, actual job content and context, and other exogenous factors)} \quad \text{(1c)}$$

Actual Reenlistment Decision = f_4 (propensity to reenlist, initial military career intentions, job satisfaction, reenlistment bonuses, perceived civilian opportunities, and other exogenous factors) (1d)

In Eqs. (1b) and (1c), the individual's propensity to reenlist can simultaneously influence his job satisfaction and his evaluation of military experiences and personal interaction with supervisors and coworkers. Thus, a feedback relationship probably exists among initial military career plans, reenlistment intentions, and the organizational explanatory factors. As the enlistee approaches the actual first reenlistment decision point, the initial career motivation should, on average, have less influence. This sequence of recursive and feedback relationships, along with the individual's expectations of being eligible to reenlist[5] and the levels of reenlistment bonus awards offered (if any) for the specialty, will help to determine his actual decision to continue military service or return to civilian life. In sum, if one wishes to model the first-term reenlistment process statistically, the time at which intent is measured must be considered.

PREVIOUS ATTEMPTS TO MEASURE REENLISTMENT INTENTIONS

Given the fact that military turnover is assumed to evolve from a continuous decision process, the selection of a single measure of reenlistment intent to predict actual reenlistment behavior is not straightforward. That is, intentions to reenlist can change during the first term; hence, one has no guarantee that stated intentions will lead to actual reenlistment. The following discussion will examine what is known about the relationship between (a) stated intentions and final reenlistment decisions, and (b) length of service and stated intentions.

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[5]All persons desiring to reenlist are not permitted to do so because (a) military career manpower requirements for certain specialties have been reduced and/or (b) an individual's performance or ability to adjust to military life may not be satisfactory. Many of the eligibility decisions appear somewhat arbitrary and require much subjective evaluation. The criteria used also vary both within and between the military services over time.

A review of past studies reveals *no* attempt to measure either the *reliability* or *stability* of stated reenlistment intentions for periods *greater* than *1 year* prior to the End of the Active Term of Service (EATS). Using a sample of enlisted Navy personnel during the *last 12 months* of the first term, Lockman et al. [17] found no statistical correlation between the months remaining before EATS and *definite* reenlistment intent.[6] The months remaining before EATS were also not correlated with the *actual* first-term reenlistment decisions, for this Navy sample. The conclusion is that definite reenlistment intentions are stable over the last year of the first term.

A simple correlation of 0.44 was found between Navy personnels' reenlistment intent and the actual reenlistment decision during the final year of their first term. It is interesting to note that as an indication of the reliability of stated intentions for all persons surveyed, the actual reenlistment rate was nearly *twice* the intent rate.[7] Moreover, the actual reenlistment decision was *more predictable* (in terms of explained variance) than intent. However, if intent was included as an explanatory variable, it had a very significant effect on the actual decision.

An analysis by Brunner [3] of Air Force enlisted personnel 1 year prior to EATS found that nearly 90 percent of those who had *definite* reenlistment plans carried them out.[8] The Air Force and Navy study indicated an important difference between "draft-induced" and "true volunteer" reenlistment intentions. A significantly greater percentage of true volunteers expressed a definite intent to reenlist. However,

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[6] First-term reenlistment intent was measured as a binary variable either "Yes" or "No."

[7] The sample only contains those Navy personnel eligible for reenlistment.

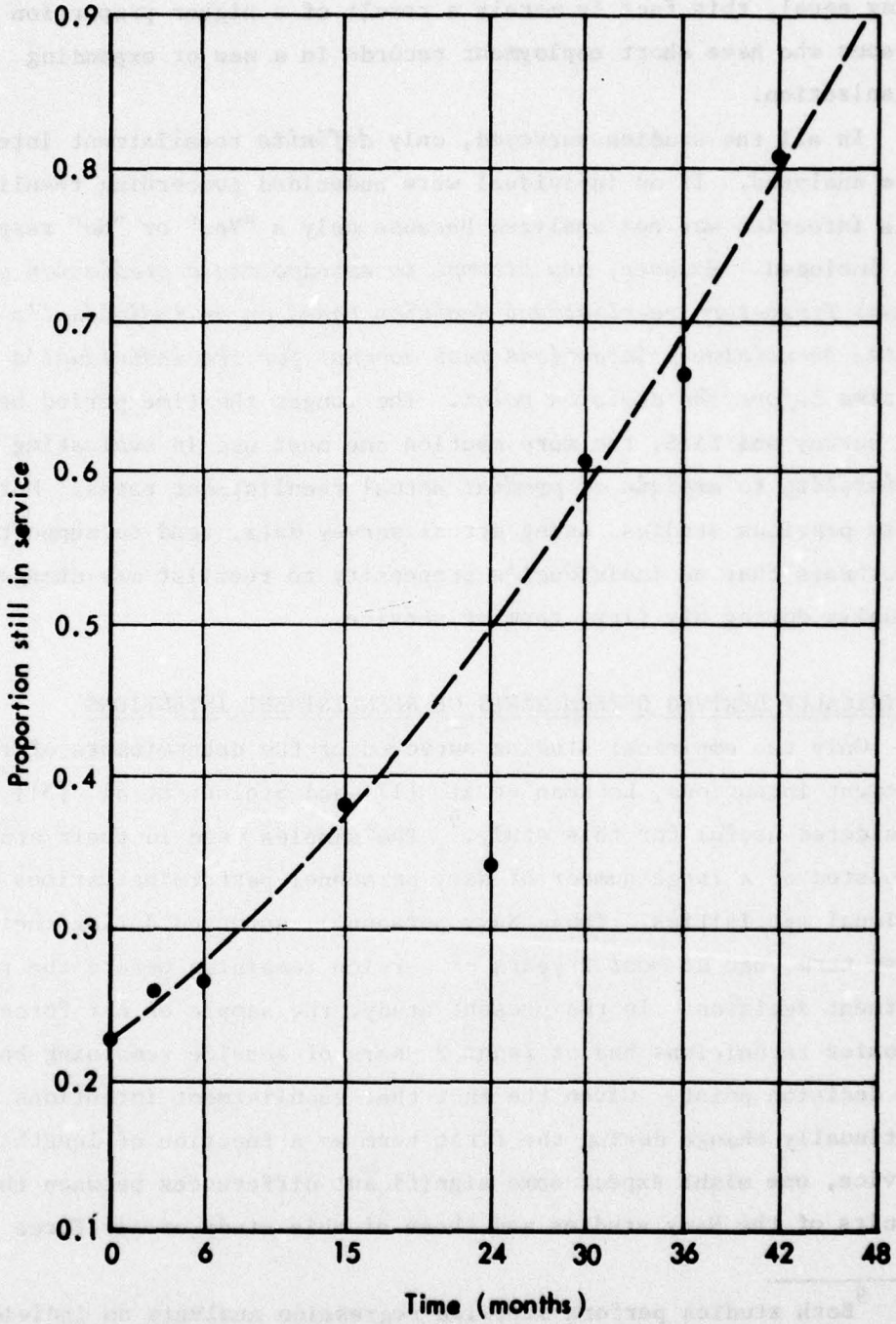
[8] A recent analysis by Rand colleagues Michael Polich and Winston Chow found that 83, 94, and 88 percent, respectively, of Army, Navy, and Air Force first-term personnel surveyed 1 year prior to EATS having *definite affirmative* reenlistment intentions did in fact reenlist. *However*, of the Army, Navy, and Air Force personnel stating *definite* intentions *not* to reenlist, 14, 12, and 7 percent, respectively, did reenlist. Because this population in their analysis is, on average, five times greater than the personnel definitely planning to reenlist, the use of definite intentions will underestimate actual reenlistment rates by about 35 percent.

the reliability of the draft-induced volunteer who had definite plans about reenlisting was greater than for true volunteers (95 versus 83 percent, respectively).

Figure 2 shows a plot made by Morion [22] of the proportion of individuals remaining, after 4 years of service, among groups who stated an intent to reenlist during the first 4 years of service. The curve indicates a substantial *increase*, as a function of length of service, in the reliability of stated intent to reflect actual continuation decisions. Morton's study also found that the subsequent actual continuation rates are usually much greater than the anticipated rates if one uses stated reenlistment intentions.

Several explanations can be postulated for the large difference in stated definite reenlistment intentions and actual reenlistment behavior. One problem is the difficulty of measuring actual reenlistment rates. If one wishes to observe the actual first-term reenlistment decision, operationally categorizing an individual as to his end of active term of service (EATS) is not an easy matter. Factors that must be accounted for are variable terms of obligated service, broken reenlistments, early withdrawals, and extensions of the obligation to serve. Furthermore, the usual measure of reenlistment rates is based on the eligible manpower pool, i.e., those persons designated by the military services as qualified to reenlist. The eligibility standards are rather arbitrary, and vary over time between and within the military services. One can easily argue that there is a fundamental problem in distinguishing voluntary and involuntary terminations in any empirical analysis. This inherent ambiguity could be serious at the end of the first term, based on current measures of reenlistment rates.

Another explanation is that the number of losses, and the reenlistment rate itself, should depend on an individual's or group's length of service. A new group of recruits, or any organization that has recently expanded or contracted, can be expected a priori to have different reenlistment rates from one that is long-established or constant in size (see Bartholomew [1] and Perry [28]). Other things



SOURCE: Anton S. Morton, "Predicting the Impact of Policy Changes from Surveys," ***Proceedings TIMS Meeting,*** **San Francisco, February 1965, p. 14.**

Fig. 2--Proportion still in service, after 4 years, among groups who stated intentions to reenlist at various times during first 4 years of service

being equal, this fact is merely a result of a higher proportion of persons who have short employment records in a new or expanding organization.

In all the studies surveyed, only *definite* reenlistment intentions were analyzed. If an individual were undecided concerning reenlistment, this intention was not analyzed because only a "Yes" or "No" response was included. *However, any attempt to extrapolate a prediction of the actual first-term reenlistment decision based on an individual's prior stated reenlistment intentions must account for the individual's length of time before the decision point.* The longer the time period between the survey and EATS, the more caution one must use in evaluating its *reliability* to *explain* or *predict* actual reenlistment rates. Moreover, these previous studies, using actual survey data, tend to support the hypothesis that an individual's propensity to reenlist may change continually during his first term of service.

EMPIRICALLY DERIVED DETERMINANTS OF REENLISTMENT INTENTIONS

Only two empirical studies surveyed of the determinants of reenlistment intentions, Lockman et al. [17] and Stoloff et al. [31], were considered useful for this study.[9] The samples used in their studies consisted of a large number of Navy personnel performing various occupational specialties. These Navy personnel, surveyed during their first term, had *at most* 2 years of service remaining before the reenlistment decision. In the present study, the sample of Air Force avionics technicians had *at least* 2 years of service remaining before the decision point. Given the fact that reenlistment intentions may continually change during the first term as a function of length of service, one might expect some significant differences between the results of the Navy studies and those of this study of Air Force

[9] Both studies perform stepwise regression analysis on individual survey items and constructs derived from factor analysis. The explanatory variables include economic, psychological, and personnel characteristics. Only explanatory variables that related to reenlistment intent at the 1-percent level of significance are reported in the studies.

avionics technicians. Moreover, a variety of Navy specialties were studied, whereas this study only uses a sample of one Air Force specialty. However, both Navy studies did segment the sample into general occupational categories for some of the preliminary analyses. Navy electronics operators and technicians are considered the occupational group most similar to Air Force avionics technicians.

The Lockman study, using a survey of 646 Navy electronics technicians, with *at most 1 year* of service remaining before the first reenlistment decision, found that expected proficiency pay (pro-pay) had the largest relative weight[10] in explaining reenlistment intent. Of secondary and about equal importance were (a) the opinions of wife, girlfriend, and/or immediate family concerning reenlistment, (b) satisfaction with the current duty station (satisfactory job context), and (c) number of years enlisted for the first term (initial military career motivation).

The Stoloff study, using a sample of 1042 Navy electronics technicians having *at most 2 years* remaining in their first term of service, found job-satisfaction-type variables[11] the most important. The next group of significant explanatory variables was anticipated pro-pay, the initial reason for enlistment, number of dependent children, years of service, and satisfaction with Navy training opportunities. Length of service and number of dependent children were *inversely* related to affirmative reenlistment intentions.

These results for specific occupational categories were apparently considered preliminary and exploratory in both studies, for no attempt

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[10]The relative contribution of the explanatory variables was measured by its partial correlation coefficient in both studies. These coefficients indicate the marginal increase in R^2 resulting from the inclusion of each explanatory variable. However, because of the multicollinearity effect, the sum of the incremental contribution did not equal R^2 and consequently may not reflect the given variables' "true" proportion of explained variances (see Theil [32]). One might note that the value of R^2 reported in both studies was at most 0.25.

[11]The job satisfaction variables included the following: (a) the individual perceived the Navy as a satisfactory career; (b) the individual wanted a similar civilian job; (c) the individual had generally favorable attitudes toward the job; and (d) the individual had high morale.

was made to control for multicollinearity among the survey items used as explanatory variables.[12] Recognizing this limitation, both studies attempted to minimize the problem by using factor analysis to construct indices composed of the intercorrelated groups of variables. Unfortunately, for purposes of comparison with this study of avionics technicians, the Navy samples used for the factor analysis included all surveyed occupational categories.

Lockman et al. used a different survey and a larger sample size than the one they had used in their analysis of Navy electronics technicians. The new sample consisted of 5417 Navy first-termers with at least 2 years of service. Factor analysis was used merely to group sets of explanatory variables, but the regression analysis performed included each of the intercorrelated items. Therefore, the multicollinearity problems can still exist in the reported findings. At any rate, the most important explanatory variables were (1) the wife's opinions of Navy lifestyle, (2) enlistment motivation,[13] (3) job satisfaction,[14] and (4) number of dependents.

Stoloff et al. used the same survey instrument as they had used in their analysis of the Navy electronics technicians. The sample was expanded, however, to include a total of 3115 Navy enlisted personnel with at most 2 years of service before the first-term reenlistment decision. Factor constructs[15] were calculated and used as composite indices to explain the stated reenlistment intentions. These constructs, in order of relative explanatory power, were interpreted as measuring (1) *satisfaction with Navy life and job*, (2) *enlistment*

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[12] Highly interrelated variables can lead to much imprecision in the selection of the key explanatory variables if one mechanically performs stepwise regressions.

[13] Draft-induced enlistment was related significantly to negative reenlistment intentions, whereas more dependents improved reenlistment intent in this large Navy sample.

[14] The job-satisfaction cluster included perceived job security, favorable working conditions, liking the work itself, pay, training opportunities, and supervisory interactions.

[15] A brief discussion of factor analytic methods is included in Section III.

motivation, (3) *training opportunities and utilization*, (4) *seniority and performance*, (5) *marital status*, and (6) *socioeconomic status*.[16] The profile of a "typical" Navy reenlistee, as reported by Stoloff et al. is as follows:

> He was a true volunteer at the time of enlistment, he is relatively more satisfied with his job, supervisor, and Navy life in general, his morale is higher, he has a greater amount of Navy schooling which he uses on the job, he is married, earns more money and comes from a family having a slightly lower socio-economic status than the man who does not intend to reenlist. (Stoloff et al. [31], p. 56.)

One could add to the above reenlistee profile that the typical reenlistee tends to have a longer length of service and higher performance ratings, and is also closer to the reenlistment decision point, than the person who does not intend to reenlist. A comparison of only the results for Navy electronics technicians would have been more appropriate for this study of Air Force avionics technicians; however, because of methodological and sampling differences, the results based on the entire Navy samples are compared as well.

CONCLUDING COMMENTS

The empirically derived explanatory factors influencing first-term reenlistment intentions of Navy personnel support previous theoretical approaches and the conceptual form of the propensity-to-reenlist equations. The overall concept of job satisfaction, both in terms of *content* (satisfaction with the work, training provided, and training used on the job) and *context* (satisfaction with supervision and Navy life in general), was among the most important factors affecting positive reenlistment intents. Hence, perceptions and attitudes concerning the military organizational climate should have an important effect on an individual's tendency to remain in the service beyond the first term.

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[16] See Appendix C, Table C.1, for a description of the variables that make up each factor construct.

The significance of the enlistee's initial motivation for enlistment reflects his positive expectations about Navy life. This finding supports the importance of these expectations--and whether they have been met by subsequent on-the-job experiences and opportunities--as determinants for reenlistment.

The anticipation of a reenlistment bonus (pro-pay) for Navy electronics technicians during their last year of service was one of the two most important determinants for definite intentions to reenlist. Economic incentives are clearly shown to be fundamental to the reenlistment intentions of the more highly skilled technicians.

The profile of a typical reenlistee demonstrates that personal demographics (especially marital status), and other screening variables reflecting lower socioeconomic backgrounds, may be expected to increase defense manpower reenlistment intentions significantly. Also, a favorable attitude of the wife or family toward military life will strongly influence an enlistee's tendency to remain in a service after the first term.

Finally, the previous empirical studies indicate that the individual's length of service and time remaining before his actual reenlistment decision are important factors influencing his ultimate reenlistment decision. As an individual approaches the end of the first term, he clearly tends to reach a more definite decision about reenlistment. However, on average, actual reenlistment rates were shown to be double those predicted on the basis of stated definite reenlistment intentions even when measured during the last year of the first term. Hence, one must be very cautious in using stated initial career motivation or subsequent reenlistment intentions during the first term as predictors of actual behavior. Previous empirical evidence supports the hypothesis that the reenlistment decision emerges from a continuous or evolutionary process.

In the following sections, these findings are used as a basis for an empirical analysis of the reenlistment intentions of the Air Force avionics technicians sampled in Rand's Enlisted Utilization Survey, mentioned in Section I. Various methods are described for determining

the extent to which a technician's length of service influences his reenlistment intentions. *The discussion also addresses the difficulties of developing explanatory and predictive statistical models for the qualitative variable measuring undecided as well as definite reenlistment intentions.*

III. METHODOLOGY

INTRODUCTION

Rand's Enlisted Utilization Survey[1] was administered mainly to determine the effect of military training on productivity. But the survey also contains data relevant to the examination of first-term reenlistment intentions among AFS-326 avionics technicians. Because of the training orientation of the survey, most of the avionics technicians in the sample were at their first duty station (about 96 percent) and had at most 2 years of service. Only about 6 percent of the sample had more than 2 years of service (see Table 2). The reenlistment decision would, on average, occur at least 2 years later for

Table 2

SAMPLE DISTRIBUTION OF AVIONICS TECHNICIANS, BY LENGTH OF SERVICE

Months of Service	Sample Size	Percent of Total
0-6	1	0.2
7-12	102	24.0
13-18	208	48.9
19-24	89	20.9
25-30	7	1.7
31-36	3	0.7
37+	15	3.5
Total	425	100

most of these technicians. Therefore, one must exercise caution in attempting to extrapolate actual future reenlistment behavior based on these responses.

In addition to providing a measure of reenlistment intentions up to midway through an enlistee's first term, Rand's Enlisted Utilization Survey also provided many explanatory variables for measuring

[1] See Appendix A.

individual attitudes and perceptions of Air Force attributes and experiences, both economic and noneconomic, compared with those in civilian employment. Those variables that should influence military reenlistment include initial military career motivation on enlistment; relative satisfaction in terms of job content and context; Air Force pay and fringe benefits, training opportunities, and utilization. One can also control for background variables, such as sex, age, race, marital status, education, length of service, etc.[2] This combined data base was considered adequate for the development of an empirical strategy for estimating statistical models of the avionics technician's tendency toward withdrawal midway during his first term of Air Force service.

A general statistical approach was developed to determine the significance, relative importance, and the direction of the effect of a small number of key variables in explaining and predicting the stated reenlistment intentions of an avionics technician. The major distinctions between three possible statistical approaches are as follows:

1. Exploratory techniques are used to help detect the "natural" groups of interrelated variables existing in the data without advanced specification of any dependent variables (e.g., factor analysis, cross tabulations, and simple correlations).
2. A dependent variable is designated a priori and a single equation or a one-dimensional model is specified between it and a set of explanatory variables (e.g., regression analysis).
3. A multiequation or multidimensional relationship is specified a priori between the set of explanatory variables and the dependent variable (e.g., discriminant and logistic analysis).

An integrated empirical strategy was devised in which a combination of all three approaches was used.

SURVEY RESPONSES BY AVIONICS TECHNICIANS

The survey question pertaining to the reenlistment intentions of

[2] See Table A.1 in Appendix A.

AFS-326 avionics technicians was

> Do you IN FACT intend to reenlist when you finish your present period of enlistment?
>
> [ ] 1. YES
> [ ] 2. UNDECIDED, BUT PROBABLY YES
> [ ] 3. UNDECIDED, BUT PROBABLY NO
> [ ] 4. NO

Table 3 shows the distribution of the responses of the 425 avionics technicians in the survey sample. Only a very small number (about 6 percent) had *definite* affirmative reenlistment intentions, whereas most of them were undecided. A very large number (41 percent) stated definitely that they did not plan to reenlist at the end of the first term.

Table 3

DISTRIBUTION OF AVIONICS TECHNICIANS' RESPONSES TO REENLISTMENT INTENTIONS

Response	Number of Responses	Relative Frequency (percent)[a]
No	172	41.0
Undecided, but probably No	105	25.0
Undecided, but probably Yes	116	27.6
Yes	27	6.4
Missing	5[b]	---
Total	425	

[a] Excluding missing data of (5/425) or 1.2 percent.

[b] Three individuals checked both undecided responses and were excluded from the analysis, and two individuals did not respond to the question.

Previous research of military survey data found, however, that actual reenlistment is uniformly greater than stated reenlistment intentions (see Brunner [3], Morion [22], and Lockman et al. [17]).

The research reported by Morion [22] indicated that the reliability of stated intent for predicting actual first-term reenlistment behavior varies directly with length of service. Lockman et al. [17] concluded that reenlistment intent was constant during the *last year* of the first term.

If one scales the avionics technicians' reenlistment responses between zero and one by letting No = 0; Undecided, but probably No = 1/3; Undecided, but probably Yes = 2/3; and Yes = 1, and then plots the average reenlistment intent score by years of service for the sample, a U-shaped curve results (see Fig. 3). The downward trend between 0 and 2 years of service suggests a decline in the average propensity to reenlist up to midway during the first term. The slight increase in the average reenlistment intent beyond 2 years of service may represent a more reliable indication of actual future behavior. Unfortunately, given that only 6 percent of the sample had more than 2 years of service, and that the sample is cross-sectional, little confidence can be attached to the observed upward trend associated with this small group.

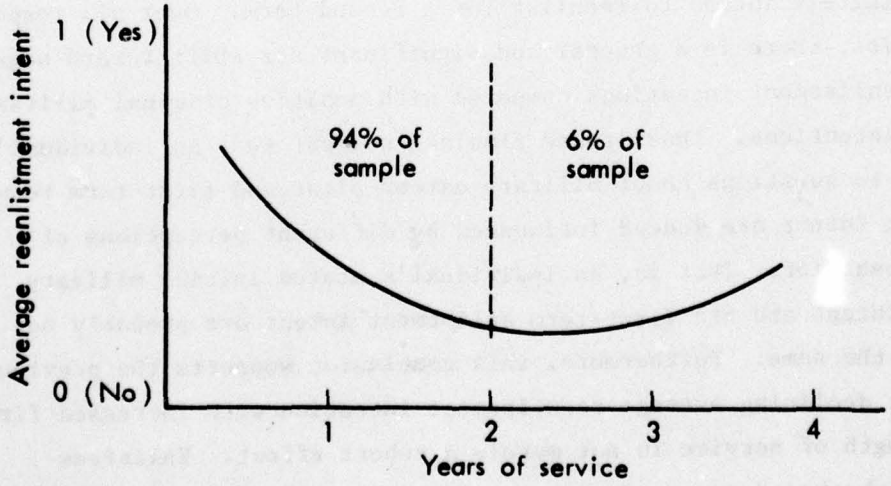

Fig. 3--Reenlistment intent, by years of service, for AFS-326 avionics technicians

The following question regarding the technician's military career motivation upon entering the Air Force was also asked during the survey:

> At the time of your enlistment, did you *intend* to make the service a career?
>
> [ ] 1. YES
> [ ] 2. UNDECIDED, BUT PROBABLY YES
> [ ] 3. UNDECIDED, BUT PROBABLY NO
> [ ] 4. NO

One could conjecture that the response to this question is merely a proxy for the stated first-term reenlistment intent (or vice versa). Table 4 shows the technicians' current (at the time of the survey) reenlistment intentions cross-tabulated with their initial military career plans. As expected, there is a very significant statistical interaction between the two responses ($r = 0.40$; chi-square = 178 with 9 degrees of freedom). However, a large reduction (27 compared with 47, or about 43 percent) occurs between those who definitely planned to make the military a career upon entering the Air Force and those who definitely intend to reenlist for a second term. Over all response categories, there is a general and significant net shift toward negative reenlistment intentions compared with positive original military career intentions. Thus, these findings suggest that an individual's answers to questions about military career plans and first-term reenlistment intent are indeed influenced by different perceptions of future behavior. That is, an individual's stated initial military career intent and his first-term enlistment intent are probably not one and the same. Furthermore, this conclusion supports the previous one that declining average reenlistment intention with increased first-term length of service is not merely a cohort effect. Enlistees sampled who had 2 years of service could have been drawn from a population that was inherently less inclined toward career military service than those who had only 1 year. Of course, these reinforcing empirical facts do not totally eliminate the possibility of this cross-sectional bias.

Table 4

CROSS TABULATION OF THE INITIAL MILITARY CAREER PLANS AND FIRST-TERM REENLISTMENT INTENT OF AFS-326 AVIONICS TECHNICIANS[a]

Intend to Reenlist for a Second Term (during the first term) Response	Intend Military Service as a Career (at time of enlistment): No	Undecided, probably No	Undecided, probably Yes	Yes	Row Total
No	91[b] 53.2[c] 72.8[d] 21.8[e]	45 26.3 39.5 10.8	23 13.5 17.6 5.5	12 7.0 25.5 2.9	171 41.0
Undecided, probably No	19 18.3 15.2 4.6	55 52.9 48.2 13.2	21 20.2 16.0 5.0	9 8.7 19.1 2.2	104 24.9
Undecided, probably Yes	14 12.2 11.2 3.4	13 11.3 11.4 3.1	72 62.6 55.0 17.3	16 13.9 34.0 3.8	115 27.6
Yes	1 3.7 0.8 0.2	1 3.7 0.9 0.2	15 55.6 11.5 3.6	10 37.0 21.3 2.4	27 6.5
Column Total	125 30.0	114 27.3	131 31.4	47 11.3	417 100.0

[a]Chi square = 177.5 with 9 degrees of freedom, statistically interrelated at less than the 1-percent level.

[b]Count.

[c]Row (percent).

[d]Column (percent).

[e]Total (percent).

The findings of the survey sample of avionics technicians and the research surveys of other military personnel tend to reaffirm the conclusion that stated intentions can vary continually during the first term. Empirical evidence, based on the survey sample of the avionics technicians, also indicates a general decline in the group's average reenlistment intent up to midway during the first term. Beyond the

mid-point, the evidence is inconclusive, given the very small group sampled who had more than 2 years of service. Assuming that it is possible to observe an individual's propensity to reenlist during the first term, a generic representation of this intention can be drawn, as shown in Fig. 4.

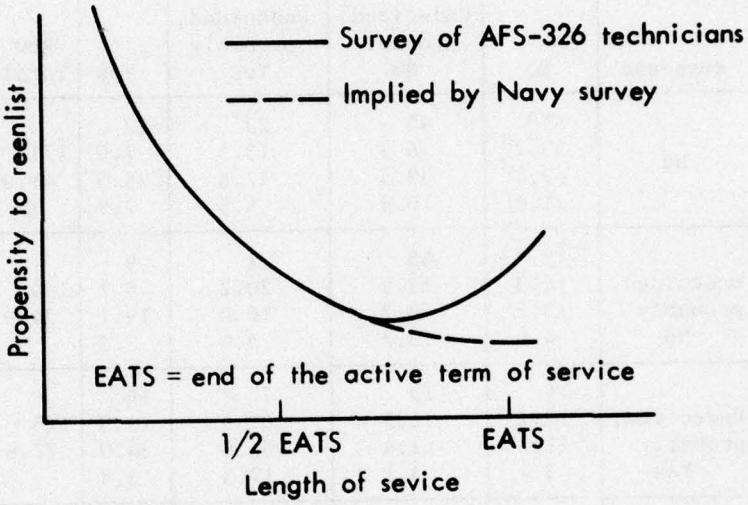

Fig. 4--Reenlistment intentions of a typical avionics technician during the first term of Air Force service

The previous research of Lockman et al. [17], using a sample of Navy enlisted personnel encompassing many specialties, indicated that definite first-term reenlistment intentions remain stable or constant during the last year before EATS (see Fig. 4). However, this Navy study, and other research studies, concluded that actual reenlistment rates are uniformly greater than those predicted by stated reenlistment intentions during the final year of the first term. Hence, the upward trend associated with AFS-326 technicians of Rand's survey sample may better reflect reality. Lockman et al. may not have been able to detect this increasing tendency to reenlist from the Navy sample because they only analyzed the correlation between *definite* reenlistment intentions and length of service (LOS) before EATS. At

any rate, the relationship between LOS and stated reenlistment intentions, both definite and undecided, will be analyzed empirically for the AFS-326 sample by using the statistical approach presented below.

EXPLORATORY STATISTICAL APPROACH

Before attempting to estimate a specified single or multiequation statistical model explaining or predicting an avionics technician's stated reenlistment intentions, it was necessary to examine a number of general problems associated with personnel survey data. Two main data problems were encountered in the Enlisted Utilization Survey:

- Missing observations within and between the survey and background data resulted from lack of a response, misunderstanding the underlying concept to be measured, or simple clerical errors.
- Redundancies incorporated into the questionnaire to increase measurement accuracy resulted in a number of explanatory variables that are intercorrelated. Certain individual demographic variables were also collinear. Thus data reduction techniques were required, as well as additional intuitive and empirical judgments, to obtain a manageable set of explanatory variables.

The problem of missing observations was solved by merely purging the data of those respondents or by eliminating specific variables from empirical consideration. The exploratory statistical approach was pursued initially to address the second and more troublesome problem. Principal components factor analysis[3] was selected as the primary

[3]Factor analysis is a generic name given to a class of techniques whose purpose consists of data reduction and summarization. This analysis can suggest combinations of variables based on underlying dimensions or latent components in the data. The principal component technique provides a systematic, efficient, and reproducible method for determining which groups of survey items are intercorrelated. For an introductory discussion of factor analyses and principal components techniques, see Van de Geer [33]; or, for a more comprehensive

reduction technique. Interest centered on description and reduction of the data rather than on statistical inference. The objective was to determine a single survey item, or combination of items, that could be used to represent intuitive and conceptually appealing constructs in the data that would influence the reenlistment intentions of avionics technicians (see Appendix B for a sample principle components factor analysis).

MULTIVARIATE AND MULTIDIMENSIONAL STATISTICAL APPROACH

The four possible responses to the question about reenlistment intentions are likely to require a multiequation or, geometrically, a multidimensional statistical approach. However, preliminary data analysis is most conveniently performed by using a single-equation model. Arbitrarily scaling these qualitative responses can give them a quantitative character in one dimension that permits the use of a standard linear regression model. For this study, the one-dimensional approach provided a simple way to ascertain the effects of various groups of reduced sets of hypothesized explanatory variables on the reenlistment intentions of avionics technicians. The results of the regression analyses could also be compared directly with the previous studies by Lockman and Stoloff of first-term reenlistment intentions of Navy personnel.

A more appropriate multidimensional statistical approach was then pursued; two models were specified and estimated for the technicians' reenlistment intentions. First, linear discriminant analyses were performed to distinguish simultaneously among the four response groups based on a reduced set of explanatory or discriminating variables. When there are more than two groups, the interpretation and the presentation of the results of the discriminant analysis have some of the practical shortcomings associated with data-reduction techniques (such as factor analysis). The problem is how, in a policy-oriented study, to isolate and test statistically the conditional effect of *each*

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treatment, see Harman [15]. Various descriptive statistics, such as means, standard deviations, cross-tabulations, and simple correlations, were calculated and analyzed before principal components analysis was selected.

of the explanatory variables on *each* of the reenlistment responses given by *each* avionics technician. An appropriate probabilistic model to solve this problem is based on the logistic distribution. Hence, a multiequation logistic model, based on the results of the discriminant and regression analyses, was also estimated.

Single-Equation Regression Model

The scaled value of the qualitative dependent variable, y_i, measuring reenlistment intent used in the regression analysis for the ith technician was

$$y_i = j \ , \qquad i = 1, 2, 3, \ldots, N \ , \tag{1}$$

where N = the avionics technicians' sample size; and letting the response scale j = 1 for No; j = 2, Undecided, but probably No; j = 3, Undecided, but probably Yes; and j = 4, Yes.

A standard linear regression model[4] is used to estimate the expected value of the scaled reenlistment response conditional on a set of p-explanatory variables, $\underset{\sim}{x}_i$, for each avionics technician. Analytically, the standard regression model may be expressed as

$$E(y_i = j | \underset{\sim}{x}_i) = \underset{\sim}{x}_i' \underset{\sim}{B} \ , \tag{2}$$

where $\underset{\sim}{B}$ = p-vector of linear coefficients associated with each explanatory variable plus an intercept term.

Various stepwise regression procedures and other interactive inclusion and deletion criteria for groups of variables were performed to reduce the set of explanatory factors to a manageable one. During the interactive analyses, certain variables were excluded if the absolute value of their coefficients' associated t-statistics were consistently less than one. This admittedly arbitrary procedure corresponds to the almost standard procedure of maximizing the adjusted $\bar{R}^2$.

[4] Ordinary least squares (OLS) was the estimation procedure.

With this type of exclusion criteria, it was easier to compare the regression results with those of the earlier studies by Lockman et al. [17] and Stoloff et al. [31], which used similar empirical strategies.

Multidimensional Discriminant Model

Linear discriminant analysis avoids the inherent statistical problems of using a standard regression model with a qualitative dependent variable[5]--the scaled stated reenlistment intent of the avionics technician. It also permits a more systematic treatment of a polytomous dependent variable than does linear regression. The analysis assumes that the values of certain sets of "discriminating" variables associated with a technician depend on his response to the reenlistment intent question. The technicians were grouped according to the four responses in the questionnaire: No; Undecided, but probably No; Undecided, but probably Yes; and Yes. Thus each group may be expected to differ in terms of the average profile or mean values of the selected discriminating variables.

Mathematically, linear discriminant analysis is a variation on the general linear model.[6] It can be used in two different ways. The simpler of the two allows one to assign a technician with hypothetical characteristics to the reenlistment-intent group most likely to display these characteristics. Thus, discriminant analysis can be used as a predictive tool. In this regard, it is little different from--and in some cases identical to--multivariate logistic analysis.[7]

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[5]See Nerlove and Press [27] and Walker and Duncan [35] for detailed discussions of the theoretical problems of using standard regression with a qualitative dependent variable.

[6]For a mathematical and geometrical treatment of discriminant analysis, see Press [30] and Van de Geer [33].

[7]For certain normality conditions on the explanatory variables, discriminant and logistic analysis make the same predictions (see Bradley [2], Haggstrom [13], and Halperin et al. [14]). When these assumptions can reasonably be said to be valid, then computationally cheaper discriminant analysis can be used as a prelude to logistic analysis in the examination of data.

The second way in which discriminant analysis is used is more distinctive. It attempts to separate the elements underlying a qualitative dependent variable into orthogonal dimensions. For example, consider the avionics technician's four possible responses to the survey reenlistment question. It is possible to consider only those groups of technicians who are definitely likely to reenlist or only those groups who do not intend to reenlist. In this dichotomous-choice case, it may be legitimate to scale the responses in one dimension, as was done in the linear regression analysis. The cardinal scaling implied by equally spacing the responses in Fig. 3 may not be correct, but *some* cardinal scaling in this one dimension should be. Alternatively, two considerations may be required to distinguish the groups--perhaps the decision to reenlist or not on the one hand and the certainty of this intended decision on the other. Then, scaling the dependent response variable in one dimension is probably not a satisfactory approach. The dependent variable is hypothesized to be composed of at least two orthogonal axes formed by the discriminating variables, and only a multidimensional analysis can fully reflect all the information present in the data. Discriminant analysis can isolate up to three orthogonal dimensions in the polytomous reenlistment response variable for the four groups. In doing this, discriminant analysis explicitly tests the comparative usefulness of multidimensional analyses on the one hand and a one-dimensional or single-equation regression approach on the other.

In sum, the main objectives to be accomplished by the discriminant analysis are the following:

- Help to determine the set of discriminating variables that best distinguishes the four response groups.
- Test the hypothesis that significant differences exist among the mean values or average profiles of the chosen set of discriminating variables for the four response groups.
- Assign or classify individuals according to the four groups, based on their value of the selected discriminating variables.

- o Determine the number of dimensions or so-called discriminant functions (linear combinations of the discriminating variables) that adequately distinguish among the response groups.
- o Interpret the implications of the selected discriminating dimensions in terms of their key variables.

Multiequation Logistic Model

There is no way to know, in a deterministic sense, how an individual will respond to a question about his intention to reenlist. This uncertainty leads one to be interested in determining the conditional probability of the individual's being in one of the four response categories based on the selected explanatory or discriminating variables. A purely probabilistic approach will avoid many of the shortcomings associated with the empirical analysis of the qualitative reenlistment-intent response for explanatory, discriminating, or predictive purposes. For example, by letting y_i designate the stated reenlistment intentions of an avionics technician, one can define the probability, p_{ij}, of the ith technician belonging to the jth response group by

$$p_{ij} \equiv P(y_i = j) , \qquad i = 1, 2, \ldots, N , \tag{3}$$

where, in the total sample of size N, the reenlistment-intent response can assume four categories or states, j = 1, 2, 3, 4; then

$$\sum_{j=1}^{4} p_{ij} = 1 . \tag{4}$$

The response probabilities are assumed conditional on the set of discriminating variables that will be determined by the discriminant analysis to distinguish the individual's stated reenlistment intentions. Analytically, this conditional probability of reenlistment intent can be expressed as

$$P(y_i = j|\underset{\sim}{x}_i) = P(\underset{\sim}{z}_{ij} \leq \underset{\sim}{x}_i'\underset{\sim}{B}_j|\underset{\sim}{x}_i) = F(\underset{\sim}{x}_i'\underset{\sim}{B}_j) , \tag{5}$$

where

$$-\infty < \underset{\sim}{z}_{ij} < \infty$$

and F( ) is a standard probability distribution,

$\underset{\sim}{x}_i$ = p-vector of explanatory variables (based on the discriminant analysis) for the ith airman,

$\underset{\sim}{B}_j$ = p-vector of linear coefficients associated with each explanatory variable plus an intercept term for the jth reenlistment response group.

The desired probabilistic characterization is provided if one chooses the distribution given by

$$F(\underset{\sim}{x}_i'\underset{\sim}{B}_j) = \frac{\exp(\underset{\sim}{x}_i'\underset{\sim}{B}_j)}{\sum_{k=1}^{4} \exp(\underset{\sim}{x}_i'\underset{\sim}{B}_k)} . \qquad (6)$$

Equation (6) is a symmetric form of the multivariate logistic model.[8] The matrix of parameters formed by the $\underset{\sim}{B}_j$ can be solved exactly by using constrained maximum likelihood procedures.[9]

The determination of an exact or *unique* functional form of the probability distribution that underlies each individual's stated reenlistment intentions does not seem possible. There probably exist a number of functional forms that are adequate; however, many may not be mathematically tractable, and if so, their estimated parameters may not have the appropriate statistical properties for hypotheses

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[8]The distribution was first suggested by Mantel [19] for a categorized response with a single explanatory factor and was subsequently extended by Press [30], Nerlove and Press [27], and others to include the multivariate case with many explanatory factors. The choice of the logistic model is not completely arbitrary. It is interesting to note that this model can be derived explicitly by using a Bayesian approach if one assumes that the explanatory variables are random with a normal distribution (see Bradley [2], Haberman [12], Haggstrom [13], Halperin et al. [14]).

[9]Iterative computer routines using the standard Newton-Rhapson technique converge rapidly for small numbers of explanatory variables and response categories associated with a reasonable sample size (see Manski [18] and McFadden [21]).

testing. The proposed multiequation logistic model has two fundamental advantages: (1) the coefficient vectors ($\underset{\sim}{B}_j$) can be estimated uniquely and have appropriate properties to perform statistical tests of hypotheses associated with each discriminating variable;[10] and (2) the model explicitly yields the direction and relative magnitude of the effect each discriminating variable contributes to the process of estimating the conditional probability that each individual will belong to *each* reenlistment-intent group. The estimated separate coefficients associated with the discriminating variables enable one to determine unambiguously a variable's effect on each reenlistment-intent group.

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[10]Hypothesis tests for the logistic model require neither the normality assumption for the explanatory variables nor the equality of within-group covariance matrices, as with discriminant analysis (see Haberman [12] and Perry [28]).

IV. EMPIRICAL RESULTS

INTRODUCTION

Through the use of regression analysis, six explanatory variables were found to be consistently and significantly related to the avionics technicians' reenlistment intentions.[1] A brief description of these variables, and of how they were measured, is given in Appendix C. The regression results are then compared with those of previous studies of the reenlistment intentions of Navy personnel.

Many interactive computations were performed, using discriminant analysis with various inclusion criteria. Essentially the *same* six variables as those obtained by the regression analysis were found to best distinguish the four groups of respondents. However, the interpretation of the discriminant results required some additional analysis to test the hypothesis of a single-equation regression model versus the multidimensional discriminant model. The multidimensional approach was concluded to be more appropriate for modeling the avionics technicians' reenlistment intentions.

Finally, the six explanatory or discriminating variables determined by the discriminant and regression analyses were used to estimate and interpret their associated coefficients for the multiequation logistic model. These cofficients permit one to isolate and test, statistically, policy inferences for *each* explanatory variable related to *each* reenlistment response--both undecided and definite.

HYPOTHESIZED EXPLANATORY VARIABLES

The Enlisted Utilization Survey and individual background data include many variables thought to influence avionics technicians'

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[1] Some of the hypothesized explanatory variables had to be excluded because of severe missing-data problems resulting either from lack of response or from questions that were not applicable. Table 5 includes the primary set of variables that was included in the regression analysis. The resulting variables also account for more of the relative variance in the dependent variable, as indicated by their so-called "Beta" coefficients. These coefficients correspond to nondimensionalizing the explanatory variables by performing a regression analysis with standardized variables (mean = 0, standard deviation = 1).

first-term reenlistment intentions. Table 5 lists the main variables considered in the empirical analysis and the expected direction of their effect. The a priori hypothesized direction is expressed in terms of the expected sign of the variable's regression coefficient.

Table 5

HYPOTHESIZED EXPLANATORY VARIABLES AND THEIR EXPECTED EFFECT ON AVIONICS TECHNICIANS' REENLISTMENT INTENTIONS

Variable	*Expected Sign*
More satisfying job than civilian employment	+
Intend to reenlist in same specialty	+
Intend to make military service a career at enlistment	+
Military pay grade	+
Military pay better than civilian employment	+
Military fringe benefits better than civilian employment	+
Military job security better than civilian employment	?
Career preference to supervise others	?
Months of service	-
Married	+
Number of dependents	+
Race {1 = black or other minority; 0 = white}	+
Years of education	-
Years of parents' education	-
AFQT score	-
Sex	?

The studies of Navy personnel by Lockman et al. [17] and Stoloff et al. [31], as well as behavioral and economic theory, suggest that the relative job satisfaction index should have a positive and important impact on affirmative reenlistment intentions. Similarly, if an avionics technician preferred to remain in that specialty, he would probably be more likely to reenlist. The met-expectancy theory and the studies of Navy personnel also indicate the positive influence of initial military career intentions on reenlistment tendencies.

Both the Navy studies and economic theory support the significance and the direction of the effect of greater Air Force pecuniary incentives (military pay and fringe-benefit package), compared with perceived

civilian opportunities, on the increased likelihood of reenlistment by avionics technicians. Higher pay grade was also expected to enhance the technicians' tendency to reenlist. This explanatory variable would be perceived by the technicians as indicating satisfactory performance and its associated award.

The expectancy theory and the hypothesized dynamic nature of the reenlistment decision suggest that length of service is an important variable. Years of active duty and months to end of active service helped to form the *Seniority/Performance* factor developed by Stoloff et al. (see Appendix C, Table C.1), which was an important explanatory variable in their analysis. Length of service was inversely related to reenlistment intentions in the Lockman study of Navy electronics technicians. As shown in Fig. 3, the average avionics technician's propensity to reenlist also declines with increased tenure up to the second year of service. Hence, it is hypothesized that reenlistment intentions are negatively related to months of service during the first term.

The job security of the Air Force relative to that in civilian employment, and a career preference to supervise others, were among the principal variables of the reenlistment-job-satisfaction factor construct (see Appendix B, Table B.2). These variables were considered to influence the reenlistment intentions of avionics technicians; however, the direction of their effect is uncertain.[2]

The Stoloff study found a positive relationship between marital status and reenlistment intentions. The two studies of Navy personnel indicated that number of dependent children could increase or decrease first-term reenlistment intentions. As a result of the correlation between marital status and number of dependents, both variables are hypothesized to be positively related to increased reenlistment tendencies.

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[2]Using the *total* Navy samples, perceived job security was found by Lockman et al. [17] to increase enlistment motivations and by Stoloff et al. [31] to enhance job satisfaction. However, the direct effect of job security on the reenlistment intentions of skilled electronics technicians is not clear.

Lower socioeconomic status was shown to increase reenlistment intentions of Navy personnel in the Stoloff study. This factor construct included father's educational level, family living conditions, and the enlistee's years of education (see Appendix C, Table C.1). Individual variables such as an avionics technician's race and educational attainment, as well as his parents' education, should relate to his socioeconomic background. Increased educational levels by either the technician or his parents should decrease his reenlistment intentions. If the technician is black or a member of another minority group, he should be more likely to plan on reenlisting.

The other individual variables considered were AFQT scores and sex. Higher intelligence scores would probably reflect greater civilian job opportunities and hence decrease reenlistment tendencies. However, the effect of sex on reenlistment intentions is not clear.

The group of variables in Table 5 provided the input vector to explain stated reenlistment intentions of the Air Force avionics technicians. The results of the regression analysis, in which these explanatory factors are used to estimate the propensity-to-reenlist equation for these technicians, will be discussed below.

THE EMPIRICALLY DETERMINED EXPLANATORY VARIABLES

For all practical purposes, the six key explanatory variables determined by the regression analysis are considered statistically and linearly independent.[3] In terms of their relative importance and the direction of their effect, these variables are intuitively appealing and are consistent with an a priori conceptual framework for studying military turnover. The estimated model also supports the results of similar previous empirical studies of the reenlistment intentions of Navy personnel.

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[3] Interactions and correlations existed between explanatory variables, such as base pay and length of service; base pay and marital status; marital status and number of dependents; education and mental test scores; satisfying work and personal freedom in the military relative to civilian life; etc. The extent of collinearity in the data was further reduced by determining the sensitivity of estimated regression coefficients of single items instead of composite indices to represent interrelated items. The six explanatory variables selected represent the set considered to minimize collinear problems.

One observes in Table 6 that the single variable having the highest significance and accounting for most of the explained variance in the avionic technician's reenlistment response is *military career intent* on entering the Air Force (ENRPL).[4] The next most important variables influencing reenlistment intentions are composite responses in which the technicians compared the Air Force with civilian employment. The most statistically reliable of these composites (JOBSAT) is related to the technician's *satisfaction with the work, training experiences, and personal freedom* in the Air Force *relative* to civilian employment. The other composite factors were the technician's perceptions of the *military fringe benefit package* (FRINGB--medical, housing, retirement) and the *military pay* (MILPY) *relative* to civilian opportunities. Apparently the most important background attribute for this highly skilled and highly screened specialty is *marital status* (WED). The remaining two variables in the selected set indicate the technician's career-path *preference for becoming a supervisor* (CPATH) and his *length of service at the first duty station* (MAS).

The regression analysis in Table 6 provides us with the following profile of a "typical" Air Force avionics technician intending to reenlist:

> *He was a true volunteer at enlistment with firm intentions of making the Air Force a career; he is relatively more satisfied with his job, training opportunities, and personal freedom as compared with civilian employment; he is married, considers his Air Force pay and fringe benefits package to be relatively better than civilian opportunities, has fewer months of service on the job, and has a greater preference for supervising others than does an avionics technician who does not intend to reenlist.*

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[4] Initial military plans were expected to have a strong influence on reenlistment intentions *up to midway* during the first term. However, given the continuous aspects of the decision process, the relative explanatory power of initial military career intentions at entry in the Air Force should decrease as an avionics technician nears the end of the first term. The Lockman study of Navy electronics technicians sampled during the last year of service before EATS provides some evidence of the reduced explanatory power of initial career motivation (see Section II).

Table 6

REGRESSION ANALYSIS OF AVIONICS TECHNICIANS' FIRST-TERM REENLISTMENT INTENTIONS

(Sample size (N) = 390)[a]

Dependent Variable, $y = \begin{cases} 1, \text{ No} \\ 2, \text{ Probably No} \\ 3, \text{ Probably Yes} \\ 4, \text{ Yes} \end{cases}$

Variable	Regression Coefficients		t-statistic
	$\hat{B}$	Beta[b]	
JOBSAT	0.701	0.340	8.540[c]
ENRPL	0.355	0.363	9.455[c]
FRINGB	0.296	0.144	3.721[c]
WED	0.341	0.162	4.306[c]
MILPY	0.168	0.111	2.956[c]
MAS	-0.013	-0.047	-1.282
CPATH	0.115	0.059	1.568
Constant	*1.000*		
$R^2 = 0.490$	$\bar{R}^2 = 0.482$	F-statistic = 52.47[c]	

[a]No missing data.

[b]The Beta coefficients are associated with standardized variables (mean = 0, variance = 1).

[c]Significantly different from zero at below the 5-percent level.

This profile is consistent with the results of the previous studies of Navy personnel reenlistment intentions, both in terms of the relative importance of the key explanatory variables and the direction of their effect. The fundamental difference between the *general* Navy reenlistee profile given in the Stoloff study and the results of the present study is the relationship between length of service and reenlistment intent. One might recall that when *only* Navy electronics technicians were analyzed by Lockman et al., the same *inverse* relationship existed between length of service and affirmative reenlistment intent as with the Air Force avionics technicians. The tenure effect, or length of time

remaining before EATS, was not included among the most important factors in the Lockman study of the *total* Navy sample. Furthermore, in Stoloff's regression analysis of the tenure effect of the total Navy sample, this variable is lumped with length of service remaining before EATS, age, pay grade, and performance ratings to form a Seniority/Performance factor construct (see Appendix C, Table C.1). Therefore, no explicit measure of the impact of length of service on reenlistment intent is available in either Navy study.

One may also note that the lack of significance of background or socioeconomic variables (with the exception of marital status) in both analyses where *only* Navy electronics technicians are considered is supported by this study of Air Force avionics technicians. These results are not too surprising given the fact that most Navy and Air Force electronics technicians are considered the "cream-of-the-crop" in terms of high AFQT scores, aptitude tests, and previous education. The percentage of minorities or women in the sample of Air Force avionics technicians was negligible (less than 5 percent). In addition, there is fragmented evidence, provided by Goodstadt and Glickman [11], that much of the remaining effect, if any, associated with the demographic attributes may be captured by the initial military career intention upon enlistment variable. This conclusion has tentative support based on the results of the Stoloff study, in which the total Navy sample encompassed all occupational categories. In that study, the socioeconomic status index was the *least* important factor, in terms of relative explanatory power, in the reenlistment-intent equation.

LIMITATIONS OF THE REGRESSION ANALYSIS

The set of key explanatory variables derived by using the regression approach clearly provides important insights into the problem of distinguishing between individuals who intend to reenlist and those who do not. However, for prediction purposes, serious statistical limitations occur if one attempts to use regression analysis with a qualitative dependent variable measuring reenlistment intent. Moreover, one may not be able to make explanatory or policy inferences

about *each* of the reenlistment-intent response groups when regression analysis is used, because all groups are lumped together in a single-equation model. That is, one cannot use the regression approach to make separate inferences about, say, the undecided groups. From a manpower-policy standpoint, the avionics technicians who are undecided about reenlistment midway during the first term are a very critical group. One would expect a higher probability to exist for influencing undecided respondents than definite respondents. Thus, a single-equation regression model may not be adequate to explain or predict the qualitative reenlistment-intent response of avionics technicians.

DETERMINING THE NUMBER OF DISCRIMINANT FUNCTIONS

Two questions can be posed in the use of the discriminant analysis to help one determine if a one-dimensional or a multidimensional model is needed:

- How many discriminant functions or dimensions (weighted combinations of the explanatory variables) are appropriate to distinguish the four groups of respondents?
- How well do the functions and chosen variables distinguish the four response categories? In other words, how well do the chosen functions assign individuals to the correct reenlistment response group?

A maximum of three linearly independent dimensions (functions) exist that could distinguish the four response groups. A number of tests were used in determining the importance of each discriminant function. One test is that all three of the discriminant functions are statistically significant at less than the 5-percent level.[5]

[5]This test may be interpreted as a multidimensional analog of the familiar test for statistical significance of the difference between sample means. Depending on sample size, statistical significance alone may be a poor indicator for determining which variables or how many functions are needed to distinguish the respondent groups adequately. If the sample sizes are sufficiently large, the group means can be virtually identical and there could be significant statistical differences.

Another, more appropriate, test is if the percentage of respondents classified correctly is greater than would be expected purely by chance. The results in Table 7 indicate that overall the discriminant analysis classification procedure provides a greater percentage of accurate classifications than would be expected by chance, i.e., 60 percent versus 30 to 40 percent by chance (see Appendix D, Eqs. D.1 to D.5).[6] If the discriminant analysis had not done much better at classifying the four groups of respondents than the chance measures, one could argue that it should be discarded and that every technician should be placed in the largest group--the No respondents group. The classification procedure has defeated the odds by assigning any technician to the smallest group, i.e., to the Yes respondents.[7] One's ability to observe how well these technicians are classified correctly corresponds to determining the overall ability of the functions to discriminate. The number of technicians correctly assigned as Yes respondents is significantly improved if *all three* discriminant functions are used to classify this group (see Table 7).

Thus, on balance, given all the tests and criteria discussed, it is concluded that all three discriminant functions are necessary to

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[6]These classification percentages should be evaluated with caution. The typical computer program used to perform the discriminant analysis has an upward bias that can occur in the classification tables. This bias is a result of the programs' using all observations to calculate the discriminant functions and then classifying the same individuals with these functions. A method of avoiding this bias is to use only part of the data to calculate the discriminant functions and then use these functions to classify the remaining cases (see Frank et al. [10]). As a first attempt at reducing this possible bias, the discriminant functions were calculated with only part of the sample (those observations with no missing data, i.e., 390; see Appendix D, Table D.1), but the classification tables are based on the assignment of all 420 technicians that were identified by reenlistment-intent group.

[7]The Bayesian approach of adjusting for a priori odds, based on the relative size of the groups, was used when classifying respondents. Therefore, even fewer individuals will be expected to be classified in the Yes group by chance. Thus, if the groups are greatly unequal in size, it becomes more difficult to interpret the classification table. At any rate, it is argued that by evaluating the *correct* classification of members of the Yes group, one can more clearly distinguish the discriminating power of the functions.

Table 7

DISCRIMINANT ANALYSIS CLASSIFICATION TABLE

Groups	Actual Response[a]	Predicted Response			
		Group 1	Group 2	Group 3	Group 4
Functions 1, 2, and 3					
1 No	172	141	19	12	0
2 Undecided, probably No	105	54	23	28	0
3 Undecided, probably Yes	116	18	17	78	3
4 Yes	27	0	1	15	11
Percent Classified Correctly = 60.24 Proportional Chance Probability (Pc) = 0.33[b] Maximum Chance Probability (Pmax) = 0.41[c]					
Function 1					
1 No	172	142	14	16	0
2 Undecided, probably No	105	58	11	36	0
3 Undecided, probably Yes	116	20	12	81	3
4 Yes	27	0	0	18	9
Percent Classified Correctly = 57.86 Proportional Chance Probability (Pc) = 0.34[b] Maximum Chance Probability (Pmax) = 0.41[c]					
Functions 1 and 2					
1 No	172	142	15	15	0
2 Undecided, probably No	105	56	11	38	0
3 Undecided, probably Yes	116	19	10	82	5
4 Yes	27	0	0	25	2
Percent Classified Correctly = 56.43 Proportional Chance Probability (Pc) = 0.34[b] Maximum Chance Probability (Pmax) = 0.41[c]					

[a] Total sample (includes observations with missing data) = 420.

[b] See Appendix D, Eqs. (D.1) through (D.3).

[c] See Appendix D, Eqs. (D.4) and (D.5).

adequately distinguished among the four groups of respondents. *This fundamental conclusion supports the hypothesis that no single function or dimension associated with the discriminating variables is adequate to model statistically the stated reenlistment intentions of the avionics technicians.*

INTERPRETATION OF THE DISCRIMINANT FUNCTIONS

The coefficients associated with the standardized discriminating variables[8] in Table 8 constitute the relative contribution of these attributes to each discriminant function's value, or so-called discriminant score. These coefficients therefore help one to interpret the calculated functions and policy implications associated with them. The first discriminant function relates primarily to an avionics technician's *military career intent upon entering the Air Force* (ENRPL) and, to a slightly lesser degree, to his *relative job satisfaction in the military* compared with his perceived opportunities in civilian occupations (JOBSAT). This first discriminant function accounts for about 91 percent of the variance in the discriminating variables among all four groups of respondents (see Table 8). The second discriminant function is interpreted as reflecting the *length of service on the first duty station* (MAS), or the tenure effect. Finally, the third discriminant function is thought to indicate mainly the avionics technician's *career-path preference for becoming a supervisor* (CPATH).

One may plot the mean discriminant score for each response group, with the discriminating functions serving as the coordinate axes. Interpretation of the axes, in terms of the key discriminating variables, allows one to infer manpower policy implications associated with each discriminant function for each group of reenlistment responses.

Figures 5a and 5b show that the first discriminant function clearly distinguishes the definite No from the definite Yes reenlistment intentions. That is, if an avionics technician had intended to make the Air Force a career at enlistment, and now feels that he has a relatively more satisfying job compared with what he perceives to be his civilian opportunities, he is more likely to definitely plan to reenlist than not to reenlist. *It is interesting to note that along this first*

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[8]The variables are transformed to a mean of zero and a variance of one. Thus, any discriminant function's value represents the number of standard deviations that the technician is away from the mean for all respondents along that dimension. Normalizing the variables by their standard deviations is also justified theoretically, since the discrimination is then based on statistical separation between the group means, and the distances are measured in units of standard deviations (see Morrison [23] and Van de Geer [33]).

Table 8

DISCRIMINANT ANALYSIS OF AVIONICS TECHNICIANS' FIRST-TERM REENLISTMENT INTENTIONS

Sample Size in Each Respondent Group[a]				
(1) No	(2) Probably No	(3) Probably Yes	(4) Yes	Total
159	96	110	25	390

Variable	Discriminant Function Coefficients[b] $\hat{B}_1$ Function 1	$\hat{B}_2$ Function 2	$\hat{B}_3$ Function 3
JOBSAT	0.485	-0.195	-0.497
ENRPL	0.519	0.045	0.118
FRINGB	0.208	0.312	-0.361
WED	0.236	-0.262	0.038
MILPY	0.161	-0.392	0.571
MAS	-0.067	-0.710	-0.034
CPATH	0.085	0.405	0.644
Relative percentage of data variance	91.4	5.5	3.1
Chi-square statistic[c]	289.2[d] (21)	33.5[d] (12)	12.2[d] (5)

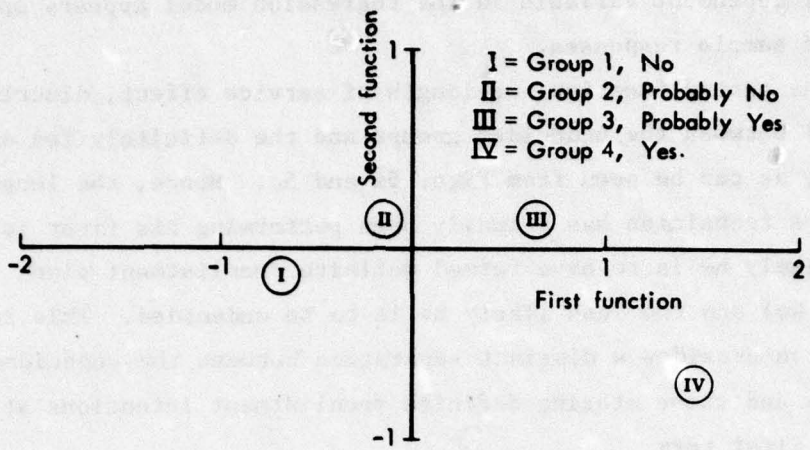
[a]No missing data.

[b]All coefficients are associated with standardized variables (mean = 0, variance = 1).

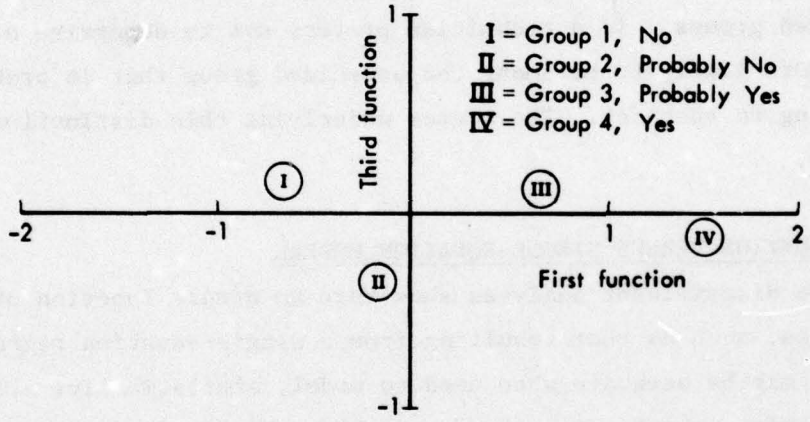
[c]Degrees of freedom are shown in parentheses.

[d]Significant below the 5-percent level.

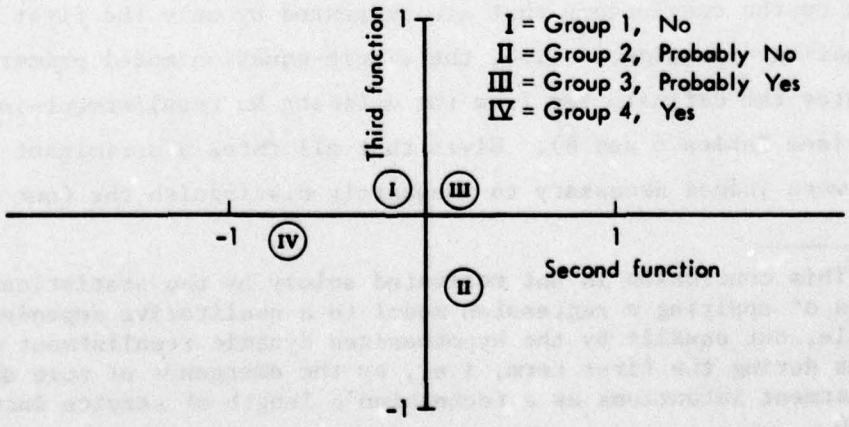
dimension, each group of respondents is about equally spaced, thus forming an interval-type scale from the definitely No group, to the two undecided groups, to the definitely Yes group. Recalling that this dimension accounts for about 91 percent of the variance in the discriminating variables, this interval relation is a possible explanation for the similarity between the results obtained with the regression model and those of the discriminant model. That is, the use of equal intervals to scale each stated reenlistment response as the



(a) Functions 1 and 2



(b) Functions 1 and 3



(c) Functions 2 and 3

Fig. 5--Group means of the discriminant scores

ordinal dependent variable in the regression model appears appropriate for the sample responses.

The second function, or length of service effect, discriminates overall between the undecided groups and the definitely Yes and No groups, as can be seen from Figs. 5a and 5c. Hence, the longer the avionics technician has actually been performing his first job, the more likely he is to have formed definite reenlistment plans (either Yes or No) and the less likely he is to be undecided. This tenure dimension provides a distinct separation between the undecided technicians and those stating definite reenlistment intentions at the end of the first term.

Finally, the third discriminant function, reflecting a technician's desire to supervise others, significantly separates the two undecided groups. If a technician prefers *not* to supervise others, he is more likely to be among the undecided group that is probably *not* going to reenlist. The reason underlying this distinction is unclear.

MULTIEQUATION VERSUS SINGLE-EQUATION MODELS

The discriminant analyses show that *no single* function of weighted variables, such as that resulting from a single-equation regression model,[9] may be adequate when used to model, statistically, all stated reenlistment intentions. If one compares the discriminant functions with the regression model, then the latter model essentially corresponds to the conclusions that are suggested by only the first discriminating dimension;[10] i.e., the single-equation model primarily separates the definite Yes from the definite No reenlistment-intent group (see Tables 6 and 8). Given that all three discriminant functions were judged necessary to adequately distinguish the four groups

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[9]This conclusion is not motivated solely by the statistical limitations of applying a regression model to a qualitative dependent variable, but equally by the hypothesized dynamic reenlistment decision process during the first term, i.e., by the emergence of more definite reenlistment intentions as a technician's length of service increases.

[10]The estimated coefficients for the discriminant functions are comparable to the regression model's Beta-coefficients, since both sets of weights are based on standardized variables.

of respondents, important manpower-policy insights may *not* be revealed by a single equation. That is, a one-dimensional model based on a single linear combination of the discriminating variables is not satisfactory to explain fully or to predict all stated reenlistment intentions, both undecided and definite.

THE ESTIMATED LOGISTIC MODEL

The key discriminating and explanatory variables, as determined by the discriminant and regression analyses, were used as input to the multiequation logistic model. A logistic equation can be estimated for each reenlistment-response group, but since the response categories are exhaustive, only three equations are independent. A response not found in any of the three reenlistment-intent categories must therefore lie in the remaining fourth category. Hence, the coefficient vectors $\underset{\sim}{B}_j$ must be constrained if the maximum-likelihood estimators are to be unique.[11] The logistic equations presented in Table 9 are for the two undecided groups and the definite Yes reenlistment responses. These groups were considered the most interesting based on the manpower-policy insights that could be gained. The constraint used to yield the estimated coefficients was to set $\underset{\sim}{B}_1$ associated with the No response group equal to zero.[12]

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[11] Press [30] has demonstrated that if one uses any linear constraint of the form

$$\sum_{j=1}^{4} \delta_j \underset{\sim}{B}_j = \underset{\sim}{\Theta}$$

such that

$$\sum_{j=1}^{4} \delta_j \neq 0 ,$$

where δ_j = scalar constants and $\underset{\sim}{\Theta}$ = (p + 1) - element fixed vector, then the maximum-likelihood estimated coefficients for the logistic model will be the same up to a scalar multiple.

[12] It can be shown that the estimated coefficients $\hat{\underset{\sim}{B}}_1$ associated with the No responses are given by

Table 9

LOGISTIC ANALYSIS OF AVIONICS TECHNICIANS' FIRST-TERM REENLISTMENT INTENTIONS

(Sample size = 390)[a]

	Logistic Coefficients								
	Group 2: Probably No			Group 3: Probably Yes			Group 4: Yes		
Variable	$\hat{B}_2$	$Beta_2$[b]	t-statistic	$\hat{B}_3$	$Beta_3$	t-statistic	$\hat{B}_4$	$Beta_4$	t-statistic
JOBSAT	1.852	0.900	4.981[c]	2.818	1.369	6.568[c]	5.254	2.552	6.661[c]
ENRPL	0.648	0.662	4.171[c]	1.339	1.368	7.239[c]	2.959	3.023	6.091[c]
FRINGB	1.089	0.530	3.410[c]	1.480	0.721	3.895[c]	2.046	0.997	2.336[c]
WED	0.505	0.241	1.702	1.136	0.541	3.246[c]	1.955	0.932	3.399[c]
MILPY	-0.261	-0.172	-1.035	0.418	0.276	1.727	0.818	0.540	2.178[c]
MAS	-0.083	-0.306	-2.155[c]	-0.089	-0.328	-1.985[c]	0.131	0.483	1.571
CPATH	0.176	0.090	0.617	0.806	0.414	2.517[c]	-0.343	-0.176	-0.601
Constant	-6.631			-12.432			-27.409		

[a]No missing data.

[b]The Beta coefficients are associated with standardized variables (mean = 0, variance = 1).

[c]Significant at below the 5-percent level.

INTERPRETATION OF THE LOGISTIC RESULTS

The results in Table 9 for the logistic model clearly support and reinforce the importance of the avionics technician's initial military career intent upon entering the Air Force (ENRPL) and his relative job satisfaction in the Air Force compared with his perception of his job opportunities in civilian life (JOBSAT). These two factors dominate all the logistic equations, both in terms of (a) their relative contribution to the estimation of the conditional probability of group membership ($\hat{p}_{ij}$), as measured by the Beta coefficients, and (b) their statistical significance. Both factors increase monotonically in importance as one moves from the equation for Probably No to that for Probably Yes to that for Definitely Yes. This finding is consistent with the results of the first discriminant function and the regression analysis. Coefficients for the fringe benefit index (FRINGB), military pay (MILPY),[13] and marital status (WED) in the equations show a similar pattern, as one might expect.

$$\hat{\underset{\sim}{B}}_1 \Big|_{\underset{\sim}{B}_4 \equiv 0} = -\hat{\underset{\sim}{B}}_4 \Big|_{\underset{\sim}{B}_1 \equiv 0}$$

if $\underset{\sim}{B}_4$ had been normalized to zero instead of $\underset{\sim}{B}_1$.

One may also use the estimated logistic coefficients to calculate the odds elasticities for any given discriminating variable, x_k. It is straightforward to show that if $\underset{\sim}{B}_1$ is the normalized vector, then

$$\frac{p_{i1}}{p_{ij}} \frac{\partial}{\partial x_k} \left(\frac{p_{ij}}{p_{i1}} \right) = b_{kj} , \qquad j = 2, 3, 4 .$$

That is, the kth discriminating variable's (x_k) elasticity of the odds in favor of an avionics technician being among the jth reenlistment group, rather than among those technicians stating definite plans not to reenlist, is determined by the variable's associated coefficient (b_{kj}) within the jth group's vector of logistic coefficients ($\underset{\sim}{B}_j$). However, since most of the discriminating variables are qualitative, any use of the elasticities to reflect the sensitivities of these odds must be considered only descriptive at best.

[13] The negative coefficient in the Probably No equation for MILPY implies that a larger military pay compared with perceived civilian wages *could* increase the relative likelihood that a Probably No respondent would definitely not reenlist. However, the statistical reliability of this coefficient's being different from zero is low, suggesting that this counterintuitive possibility should be discounted.

The logistic results explicitly demonstrate the relationship between a technician's months of service in performing his first job and his reaching definite reenlistment intentions. The significant and negative coefficients in the Probably No and Probably Yes equations confirm the reduced probability of a technician's forming definite intentions after only a few months on-the-job. The negative coefficient in the Probably No equation shows the increased likelihood that the Undecided, but Probably No, respondent will form definite intentions not to reenlist as his tenure increases. Similarly, the positive but less statistically reliable coefficient in the Yes equation supports the conclusion that longer service also increases the technician's likelihood of making definite plans to reenlist. These results are consistent with the conclusions reached with the interpretation of the second discriminant function. Moreover, these findings give additional support to the fact that the single-equation regression model did not adequately capture this dual effect of a technician's tenure on his forming definitely No as well as definitely Yes reenlistment intentions.

The results concerning the avionics technician's career-path preference for becoming a supervisor (CPATH) are somewhat puzzling. Only the coefficient in the Probably Yes equation is statistically different from zero and supports the conclusion reached using the third discriminant function, namely, that a technician desiring to supervise others is undecided, but probably intends to reenlist. This finding is useful for predictive purposes, but the erratic signs on the statistically less significant coefficients, and the lack of a good explanation for them, are disconcerting. It may also be useful to observe that the role of this troublesome variable in the discriminant analysis was also the least intuitively appealing. These results, taken together, suggest that some unexplained--and perhaps important--factor is at work in the reenlistment decision concerning the avionics technician's desire to supervise others. Future research may provide a better understanding of this factor.

CONCLUDING COMMENTS ON THE EMPIRICAL ANALYSES

Probably the most interesting and encouraging result was the convergence of all the statistical models in terms of the *same* set of key explanatory and discriminating variables. All estimated models tended to reinforce the relative importance, and most of the intuitive interpretations, of each key factor or discriminant function distinguishing the reenlistment tendencies of the avionics technicians. These results also support previous a priori hypotheses based on the initial conceptual framework for empirically studying military turnover. The set of key explanatory variables and their effects, as determined by the regression analysis, are consistent with previous research on the reenlistment intentions of Navy electronics technicians. The Navy technicians, however, were much closer to the point of actual reenlistment.

Single-equation regression results clearly provide important insights that enable one to distinguish those avionics technicians stating definite Yes or No reenlistment intentions. However, it is concluded that a multiequation model is more appropriate for analyzing, fully, all stated first-term reenlistment intentions--undecided as well as definite.

First, using the six key factors, discriminant analysis provides a method for determining the three dimensions that separate all four response groups. It can also be used to assign or predict the response group in which a technician belongs. Second, using the multiequation logistic model, one can *explicitly* determine the direction and relative effect of each key variable on the conditional probability of a technician's belonging to each of the four response groups. The empirical results provide valuable policy implications about manpower withdrawal from military service *well before* it occurs, as well as a capability for predicting each technician's reenlistment intentions based on the small set of key factors.

Although reenlistment intentions stated during the first term are generally poor *predictors* of actual reenlistment rates, these intentions have been found to be very important in selecting a set of key factors to help military policymakers *understand* the reenlistment

decision process. Previous studies of actual first-term reenlistment behavior have demonstrated that stated reenlistment intentions during the last year before EATS can be an important explanatory factor influencing the decision (see Lockman et al. [17]).[14] However, one may anticipate the relative explanatory power of some of the key variables to change over time. For example, Lockman et al. found the economic incentive, pro-pay, to be the dominant factor for Navy electronics technicians surveyed during the last 12 months before EATS.[15] On the other hand, Stoloff et al. [31], using similar data for Navy electronics technicians during the last 2 years of service before EATS, found factors relating to job satisfaction the more important. The fundamental point to be made is that *the set of key explanatory factors will probably not change significantly between mid-term and the end of the avionics technician's first term of service; however, the relative importance of some of the individual factors may change drastically.* Hence, for manpower-policy purposes, one must be very careful to consider the key factors as a *whole*--not the relative importance of *each* factor--in analyzing the reenlistment intentions of avionics technicians between mid-term and the end of their first term.

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[14]Of course, reenlistment intentions during the final 12 months before EATS would probably be more important in explaining actual behavior than intentions measured to only midway during the first term.

[15]The offering of, or an individual's expectation of, pecuniary reenlistment incentives at the end of the first term would, in part, explain the upward trend in average reenlistment intentions of avionics technicians beyond 2 years of service (see Fig. 3, Section III). That is, affirmative reenlistment intentions could increase suddenly near or at the end of the first term as a result of new or additional reenlistment bonuses. This conclusion would be an alternative explanation for some of the discrepancy between stated reenlistment intentions and actual reenlistment behavior as a function of length of service before EATS.

V. CONCLUSIONS

INTRODUCTION

The results of the statistical analysis using a sample of Air Force avionics technicians support many previous theoretical and intuitive concepts, as well as other empirical studies of first-term reenlistment intentions. The findings of the analysis, based on a range of statistical methodologies,[1] some not used traditionally in manpower policy research, tended to converge and reinforce the interpretation of the empirical results.

SUMMARY OF KEY FACTORS

The empirical results explaining the avionics technician's reenlistment intent up to midway during his first term center on six key factors. A brief summary of these factors, in order of their importance, is given below.

Military Career Intentions at Enlistment

The avionics technician's military career intentions at the time of his initial enlistment in the Air Force were found to be the most important factor contributing to his subsequent reenlistment plans. This finding is in general agreement with the findings of previous empirical studies of first-term reenlistment; i.e., if an individual plans to reenlist when he enters the Air Force, he is more likely to intend to reenlist later.

Relative Military Job Satisfaction

The second most important factor contributing to an avionics technician's reenlistment intentions is his military job satisfaction, as it compares with his perceived opportunities in civilian life.

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[1] A general empirical strategy was developed that allows one to derive a small set of key discriminating variables and to test, explicitly, hypotheses associated with each avionics technician's first-term stated reenlistment intent: "Yes"; "Undecided, but probably Yes"; "Undecided, but probably No"; and "No."

Of the three components that comprise the measure of job satisfaction, one relates to job *content* (satisfying work) and two to job *context* (training and work experiences, including the degree of personal freedom) between the Air Force and civilian employment.[2] Job content and context, as perceived by those in the avionics specialty, affect reenlistment intentions positively and appear to be of the same importance to reenlistment intent as are the military career expectations of enlistees first entering the Air Force. This finding supports the conclusions reached by much recent behavioral research concerning the influence of met-expectations on an individual's propensity to leave his place of employment.

Marital Status and Other Background Variables

The only important personal attribute or background variable consistently influencing the avionics technician's stated reenlistment intentions up to midway in his first term was his marital status. A married individual is more likely to reenlist. Marital status was also highly correlated with number of dependents and current pay grade but was chosen for inclusion as one of the six key factors rather than these two latter variables because of its stable significance levels and relative discriminating power. This multicollinearity was expected, since an individual's number of dependents and, to a lesser degree, pay level are directly related to his marital status.[3]

The lack of statistical significance of other socioeconomic or background variables is not considered too surprising, because of the homogeneous composition of the sample in terms of high AFQT scores, aptitude tests, and previous education. There is also a negligible representation of minorities or women in the sample (less than 5 percent). Furthermore, studies by others[4] support the conjecture that

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[2]The content component had the single most important influence on reenlistment intent in the job satisfaction index.

[3]Age and total length of service were also intercorrelated with marital status and pay levels.

[4]See Goodstadt and Glickman [11], Lockman et al. [17], and Stoloff et al. [31].

much of the influence of these variables may be captured by initial military career intent upon enlistment.

Economic Incentives

Both direct and indirect economic incentives influence the avionics technician's reenlistment intentions. Larger economic incentives tend to increase reenlistment. It appears, however, that the relative attractiveness of the Air Force's total fringe benefit package (housing, medical, and retirement),[5] compared with civilian benefits, had the more uniformly important economic influence on all stated reenlistment intentions. Direct wages paid by the Air Force, compared with those perceived to exist in civilian employment, seem to be almost equally important to the individual in terms of his forming *definite* reenlistment plans. Thus, the analyses support the traditional economic theory of occupational choice, and the various direct pecuniary or wage incentives used by the Air Force to increase first-term reenlistments should be effective.

Length of Service

All the analyses confirm the fact that the technician's length of service at the first duty station exerts an important influence on his intentions to reenlist. Because 96 percent of the sample consisted of technicians who were on their first duty station, and 94 percent who had at most 2 years of service, months of service at this station constituted their first on-the-job experience in the Air Force. The shorter the time that a technician has actually been performing his job, the more likely he is to be undecided about reenlisting. One might recall that the two undecided groups comprise just over 50 percent of the avionics technicians sampled. This fact, along with the findings of other empirical studies[6] of military turnover, supports the hypothesis that the decision to reenlist is a dynamic process. The implications are

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[5]Medical benefits were the single greatest contributor to the reenlistment intent in the fringe benefits index.

[6]See Lockman et al. [17], Morion [22], and Stoloff et al. [31].

that manpower policies or practices can alter a technician's propensity to reenlist as he approaches the end of his first term.

Desire to Supervise Others

The technician's desire not to supervise others (assuming equal pay for nonsupervisors) increased significantly his likelihood of being undecided but not favorable toward reenlistment. This result gives tentative support to the notion that by requiring management responsibility for career advancement, the Air Force discourages many skilled technicians from reenlisting. More research is needed to provide other than tentative support to this conclusion.

SOME AIR FORCE MANPOWER POLICY IMPLICATIONS

The results of the analyses clearly support the fact that there is a positive connection between initial career motivation and affirmative first-term reenlistment intentions for avionics technicians. Air Force recruitment and selection procedures should exploit this important connection. Studies aimed at identifying the characteristics and causes of favorable military career intentions should ultimately increase first-term reenlistments. The All-Volunteer Force should, in the long run, provide a greater number of individuals who enlist in the Air Force with positive career motivations. In other words, a more stable entering group of avionics technicians should emerge as the proportion of draft-motivated recruits approaches zero.

Three of the findings tended to mitigate, over time, the effect of initial military career motivations on first-term reenlistment intentions. First, the number of technicians stating definite reenlistment intentions was significantly less than the number who initially stated definite career plans. Second, among the avionics technicians sampled, the propensity to reenlist did, on average, decrease with increasing length of service up to midway during the first term.[7] Third, the length of time that a technician actually worked on his first job

[7]Given that only 6 percent of the sample has more than 2 years of service, very little can be said with confidence about reenlistment intentions beyond this point.

significantly contributed to his arriving at a definite intention to reenlist. Given these findings, along with the fact that the technician's relative job satisfaction had a significant effect on his reenlistment intent, it is clear that an individual's propensity to reenlist can be altered by his training and on-the-job opportunities and experiences. Apparently, the accumulation of new information about the avionics specialty, and his experience with Air Force life compared with his initial expectations about military service, were very important to the technician's reenlistment decision. This suggests that a prospective recruit who is given *adequate* and *accurate* information regarding Air Force life, training opportunities, and various occupational specialties will be in a better position to forecast accurately whether he will enlist or plan on reenlisting.[8]

Air Force career path rigidity that requires virtually all second-term, and even some first-term, avionics technicians to become supervisors is apparently having a negative effect on first-term reenlistment rates. It appears that many technicians would prefer to become more expert tradesmen (assuming equal pay for nonsupervisors) rather than be forced into a career of supervising others near or at the end of their first term of service. This conclusion supports a broader military manpower policy issue relating to the enlisted person's belief that he has no control over his career "fate."

Economic rewards have long been used as manpower policy variables to improve first-term military retention. The findings of this study support the importance of direct wages and the *total* Air Force fringe benefits package to the reenlistment of avionics technicians when these economic incentives are perceived as being equal to or better than those provided by civilian employment. Direct pecuniary benefits are less difficult to measure and manipulate for manpower-policy purposes than many of the psychological factors influencing reenlistment behavior. However, if the costs associated with various economic benefits are prohibitive, this study suggests that alternative strategies

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[8]This finding should have implications for reducing first-term attrition of avionics technicians. Suggested future research in this area is discussed below.

can be used to improve the supply of Air Force career avionics technicians: Other important policy implications for improving reenlistment intentions include (1) determining the selection and screening criteria that will better identify levels of initial military career motivations; (2) providing new enlistees with occupational counseling and with accurate and adequate information concerning Air Force service in general and the avionics maintenance field in particular; and (3) enhancing job satisfaction by providing more personal freedom and relaxing Air Force career path rigidity so that not all second-term enlistees are required to become supervisors in order to be career avionics technicians.

SUGGESTIONS FOR FUTURE RESEARCH AND DATA REQUIREMENTS

This study has concerned itself with a fundamental methodology for estimating explanatory or predictive models rather than with estimating the complete structural (causal) models of the reenlistment decision. This effort has concentrated on reenlistment intentions, whereas other Rand studies, and those conducted elsewhere, are continuing an empirical investigation of initial military career intentions and actual reenlistment decisions. However, to date, no efforts have been made to come to grips with the feedback effect and recursive nature of the reenlistment decision process by estimating the entire system of structural equations simultaneously. By continuing to estimate only single-equation models, one encounters several limitations, particularly when cross-sectional data are used. For example:

- One cannot ascertain the direction of causality between job satisfaction or job performance and the propensity to reenlist.
- One cannot test for the existence of contemporaneous feedback effects between the reenlistment-intent variable and the other endogenous factors measuring initial career motivations, job satisfaction, and actual reenlistment decisions.
- Any change in the underlying model, over time, may affect the estimated coefficients.

Single-equation models may be adequate for predictive or explanatory purposes. However, given the assumed simultaneous system of equations that exist for modeling the propensity to reenlist, job satisfaction, initial military career intentions, and the actual reenlistment decision, single-equation models can produce biased and statistically inconsistent estimated coefficients. These limitations imply that one must be careful about generalizing the estimated models to other military specialties within the Air Force or to other skilled personnel in the Navy and Army.

Many questions arose during the course of this research. The primary one, of course, was: How can one *predict* actual reenlistment behavior based on stated reenlistment intentions?

As was stated above, an individual's initial reenlistment intentions or career expectations are continually altered in accordance with his accumulation of new information and on-the-job military experiences. Unfortunately, since the data of Rand's Enlisted Utilization Survey were collected primarily for another purpose, the survey provided only two measures of an avionics technician's propensity to reenlist: his military career intentions at the time of his enlistment in the Air Force and his reenlistment intent while on the first duty station up to midway during his first term. However, the questions regarding both of these intentions were asked on the same questionnaire and thus at the same time. Hence, the technician's reenlistment intentions were not measured at the time of his *actual* enlistment. A survey approach indicating the military career intent of technicians very near the actual time of initial enlistment would eliminate any measurement error based on cross-sectional sampling.[9]

Since all questions were answered at one point in time, the length of service variable (MAS) may simply reflect cohort effects.

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[9]Stated reenlistment intent up to midway during the first term and initial military career intent were the same for only about 50 percent of the avionics technicians sampled. Thus, based on this fact and other information, it was concluded that the two responses were not surrogates for each other. Fortunately, this conclusion, along with the technician's declining average propensity to reenlist during the first 2 years of service of his first term, suggests that any measurement error is probably negligible.

A longitudinal survey would be required to totally rule out this possible cross-sectional bias.

More important than any measurement error or bias associated with a cross-sectional survey or simultaneous estimation of a system of equations, is the fact that no measure is available of the reenlistment decisions of the avionics technicians in the sample. Such follow-up data are necessary if one is to test the predictive power of the statistical models and empirical results in terms of actual behavior. Previous research by Lockman et al. [17] and Morion [22] indicated that the number of individuals who actually reenlist can be double the number of those who state definite intentions of reenlisting during the final year of their first term. Since the technicians surveyed typically had *at least 2 years* of service remaining before actual reenlistment decision, the discrepancy may be even greater.[10]

An ideal measure of reenlistment behavior would be the actual numbers of eligible and ineligible first-term enlistees who voluntarily decided to reenlist. This type of measurement would require a survey of individuals relatively close to EATS, followed by a comparison of the data for those individuals classified as eligible to reenlist with the data on actual reenlistments. Unfortunately, only a small number of individuals are eligible to reenlist at any one point in time, and the proportion of first-term reenlistees is extremely small (particularly for avionics technicians and other highly skilled specialties) compared with nonreenlistees. This situation would probably require that the EATS dates for the population surveyed be extended over a period of time to provide an adequate sample size.

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[10]The actual first-term reenlistment rates of AFS-326 avionics technicians are between 10 and 30 percent. The rate compares with only 6 percent of the technicians sampled who stated definite reenlistment intentions. However, about 11 percent stated definite career intentions at the time of enlistment.

FY 73 and FY 74 represented years of high procurement of 6-year enlistees (12.3 percent in FY 73 and 22.6 percent in FY 74 compared with 1 percent in FY 72). As prime candidates for the 6-year enlistment program, AFS 326 technicians had an even greater proportion of 6-year enlistees (e.g., 36.2 percent in FY 74). Term of enlistment determines the length of time remaining until the reenlistment decision and, hence, may be an important factor in the career-intent response.

Furthermore, observing actual losses directly, both *during*[11] and at the end of the first term, rather than only measuring attitudes and reenlistment intentions, is in agreement with current behavioral research, much of which is concerned with the operation of "cognitive dissonance"--a theory that suggests that attitudes are modified as a result of behavior (see Festinger [8]). In other words, behavior is more often the cause of attitudes or attitudal changes than conversely. Psychological variables are also much more difficult to measure, and attitudes and intentions expressed before the actual observable behavior, as indicated, can be poor *predictors*. Thus, by observing actual losses over time (ideally, by means of longitudinal surveys or at least cross-sectional sampling at various critical points during the first term), one would be better able to study, empirically, an individual's continually changing propensity to reenlist. Concurrently, individual data, such as were provided by Rand's Enlisted Utilization Survey, and other relevant information[12] could be collected to determine, well before EATS, the influence of those factors on changing reenlistment intentions and first-term attrition.

In theory, an empirical study of what changes occur in an individual's propensity to reenlist, and of actual first-term attrition before EATS as a function of length of service, would require a survey of a true cohort, i.e., a longitudinal survey of a group of technicians from time of their enlistment to their first reenlistment decisions. This survey would require at least a 4-year period. Obviously, both the cost and time involved would be high. Hence one must normally use cross-sectional samples, as in this research, for statistical analyses. The strategy employed must be one that will recognize the statistical limitations inherent in a "snapshot"-type observation of an individual's dynamic reenlistment decision process. This study

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[11]There are also significant manpower losses from this Air Force specialty prior to the end of the first term of active service.

[12]The Enlisted Utilization Survey as a measurement instrument did not measure several factors found to strongly influence reenlistment intentions, such as supervisory and co-worker interaction and the opinions of the enlistee's wife, girlfriend, or immediate family concerning his continued military service.

provides a general statistical approach for deriving a parsimonious set of key explanatory factors and for testing the influence of each factor on various stated reenlistment intents. The approach could be applied to a study of individual reenlistment intentions in other skilled military specialties at any time during the first term or beyond. A study of Air Force occupational categories other than that of avionics technicians, as well as those of other military services, would verify the general applicability of this research approach and better evaluate its potential usefulness and its policy implications.

Appendix A

ENLISTED UTILIZATION SURVEY AND BACKGROUND DATA

Rand
SANTA MONICA, CA. 90406

ENLISTED UTILIZATION SURVEY

DOD REPORTS
CONTROL SYMBOL:
DARPA (OT) 741

For Data Processing Only

■CARD 1■

1. *Is this your first duty station?* That is, did you come to this duty station immediately after completing either Air Force technical school or basic training?

21 [ ] 1. YES
[ ] 1. NO → How many months did you serve at other duty stations prior to arriving at this one?

22-23 MONTHS: _____

2. Did you attend an Air Force technical school?

24 [ ] 1. YES →
25-26 [ ] 2. NO

Where? _____
(BASE NAME)

In which AFSC were you trained?

27-31 AFSC: [| | | | |] .

Are you currently assigned to job tasks in the AFSC for which you were trained?

33 [ ] 1. YES
[ ] 2. NO → Which AFSC most closely corresponds to your current job duties?

34-38 AFSC: [| | | | |]

3. During your FIRST MONTH at this duty station, approximately what percentage of your time on duty was spent performing job tasks requiring training or experience in your specialty (as opposed to other types of work such as cleaning the work area or keeping records)? (CIRCLE ONE)

42-44 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. At the PRESENT TIME, approximately what percentage of your time on duty is spent performing job tasks requiring training or experience in your specialty? (CIRCLE ONE)

45-47 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. If you could work in the specialty of your choice, which of the following career paths would you prefer? (The pay for both would be the same.)

48 [ ] 1. BECOME A SUPERVISOR
[ ] 2. WORK IN YOUR SPECIALTY (BUT NOT SUPERVISING OTHERS)

6. In the box below please print the names of the three ***ENLISTED*** supervisors who most directly supervise you. Indicate each supervisor's rank and the average number of hours per week he spends supervising you.

■CARD 2■

MOST DIRECTLY:

12-26
27-36 NAME: LAST FIRST

41-43 RANK (CIRCLE ONE): A1C SGT SSG TSG MSG SMS CMS

45-46 HOURS PER WEEK OF SUPERVISION: _____

2ND MOST DIRECTLY:

47-61
62-71 NAME: LAST FIRST
■CARD 3■

16-18 RANK (CIRCLE ONE): A1C SGT SSG TSG MSG SMS CMS

20-21 HOURS PER WEEK OF SUPERVISION: _____

3RD MOST DIRECTLY:

22-36
37-46 NAME: LAST FIRST

51-53 RANK (CIRCLE ONE): A1C SGT SSG TSG MSG SMS CMS

55-56 HOURS PER WEEK OF SUPERVISION: _____

SECTION II. BACKGROUND

1. Were you employed before entering the service?

57 [ ] 1. YES, FULL TIME
58- [ ] 2. YES, PART TIME
[ ] 3. NO

→ In what occupation? _____ (OCCUPATION)

68-71 At what salary? $_____ PER MONTH

■CARD 4■

12-13 For how many months?

MONTHS: _____

2. Did you enlist for a specific occupational specialty?

14 [ ] 1. YES →
15- [ ] 2. NO

Which one? _____
(AFSC OR SPECIALTY NAME)

Did you get it?

21 [ ] 1. YES
[ ] 2. NO

3. At the time of your enlistment, would you have been willing to enlist for one year more than you *actually* did, without a cash bonus?

22 [ ] 1. YES
[ ] 2. NO →

Would you have been willing to enlist for one more year if a cash bonus had been offered?

23 [ ] 1. YES →
[ ] 2. NO

What is the *minimum* cash bonus you would have required?

24
[ ] 1. $1,000 [ ] 4. $4,000
[ ] 2. $2,000 [ ] 5. $5,000
[ ] 3. $3,000 [ ] 6. More than $5,000

4. At the time of your enlistment, did you *intend* to make the service a career?

25 [ ] 1. YES
[ ] 2. UNDECIDED, BUT PROBABLY YES
[ ] 3. UNDECIDED, BUT PROBABLY NO
[ ] 4. NO

5. Which of the following best describes your father's and mother's education? (CHECK ONE IN EACH COLUMN)

	FATHER	MOTHER
26-27 SOME ELEMENTARY SCHOOL	1. [ ]	1. [ ]
ELEMENTARY SCHOOL GRADUATE	2. [ ]	2. [ ]
SOME HIGH SCHOOL	3. [ ]	3. [ ]
HIGH SCHOOL GRADUATE	4. [ ]	4. [ ]
SOME COLLEGE OR TECHNICAL SCHOOL	5. [ ]	5. [ ]
COLLEGE GRADUATE OR MORE	6. [ ]	6. [ ]
DON'T KNOW	7. [ ]	7. [ ]

SECTION III. FUTURE PLANS

PLEASE ANSWER THE FOLLOWING QUESTIONS **WHETHER OR NOT YOU INTEND TO REENLIST.** *IN SOME CASES YOU MAY NOT KNOW THE EXACT ANSWER, BUT PLEASE MAKE THE BEST ESTIMATE THAT YOU CAN.*

1. If you were to reenlist, would you remain in your current specialty?

28 [ ] 1. YES
29- [ ] 2. NO →

What specialty would you reenlist for? _____
(AFSC OR SPECIALTY NAME)

2. If you were to reenlist, what would probably be your pay grade in the first year of your second term? (CIRCLE ONE)

35-36 E3 E4 E5 E6 E7

3. If you were to leave the service at the end of your first term of enlistment, would you return to school?

37 [ ] 1. YES, FULL TIME
[ ] 2. YES, PART TIME
38 [ ] 3. NO

→ For how many years?

YEARS: _____

What type of school?

39 [ ] 1. VOCATIONAL/TRADE SCHOOL
[ ] 2. COLLEGE
40- [ ] 3. OTHER (SPECIFY) _____

4. If you were to leave the service at the end of your first term of enlistment, would you get a job?

42 [ ] 1. YES, FULL TIME
43- [ ] 2. YES, PART TIME
[ ] 3. NO

→ In what occupation? _____
(OCCUPATION)

53-56 At what salary? $ _____ PER MONTH

5. Do you IN FACT intend to reenlist when you finish your present period of enlistment?

57 [ ] 1. YES
[ ] 2. UNDECIDED, BUT PROBABLY YES
[ ] 3. UNDECIDED, BUT PROBABLY NO
[ ] 4. NO

6A. Is military life better or civilian life better in the following areas, or do you think there is no difference? (CHECK ONE COLUMN FOR EACH ITEM)

	AREAS	MILITARY BETTER	NO DIFFERENCE	CIVILIAN BETTER
		1	2	3
58	A. Pay	[ ]	[ ]	[ ]
59	B. Training and job experience	[ ]	[ ]	[ ]
60	C. Retirement benefits	[ ]	[ ]	[ ]
61	D. Housing benefits	[ ]	[ ]	[ ]
62	E. Job security	[ ]	[ ]	[ ]
63	F. Personal freedom	[ ]	[ ]	[ ]
64	G. Medical benefits	[ ]	[ ]	[ ]
65	H. Satisfying work	[ ]	[ ]	[ ]

6B. Now, in the boxes below, please write in the letters of the three most important items affecting your reenlistment decision.

- IF YOU PLAN TO REENLIST, the three items should be your three most important reasons **FOR** reenlisting.
- IF YOU DO NOT PLAN TO REENLIST, the three items should be your three most important reasons for **NOT** reenlisting.

MOST IMPORTANT	SECOND MOST IMPORTANT	THIRD MOST IMPORTANT
66-68 ☐	☐	☐

69-72

Table A.1

AVIONICS TECHNICIANS' INDIVIDUAL BACKGROUND DATA

AFQT percentile	(AFQT)
Region (regional location of the duty station)	(REG)
Length of service (months)	(LOS)
Months at duty station	(MAS)
Sex (male, female)	(SEX)
Race (white, nonwhite)	(RACE)
Ethnic group	(ETGP)
Marital status (married, not married)	(WED)
Number of dependents	(DEPS)
Term of enlistment (years)	(TERM)
Pay grade (E1, E2, etc.)	(PG)
General aptitude (percentile)	(GAPT)
Mechanical aptitude (percentile)	(MAPT)
Clerical aptitude (percentile)	(CAPT)
Electrical aptitude (percentile)	(EAPT)
Age (years)	(AGE)
Years of civilian education	(YED)

Appendix B

PRINCIPAL COMPONENTS ANALYSIS OF THE SURVEY AND BACKGROUND DATA

Simple correlations and cross-tabulations indicate there were possible redundancies in the data, resulting in groups of variables that could be collinear (for examples, see Table B.1). This expected finding suggested two strategies for reducing the groups of items into independent explanatory factors:

1. Statistically combine items that are highly correlated to form a composite measure; or
2. Select a single item to represent a group of interdependent variables.

Principal components factor analysis was the method used as an aid in this process. Unlike some of the less-structured factor analytic procedures, this technique provides unique and reproducible results to determine which groups of variables are highly intercorrelated. The calculated components, which are linearly independent, may suggest combinations of items or individual items representing underlying dimensions or constructs in the data, i.e., hypothetical or intuitively appealing "latent" variables that cannot be accurately observed directly. One can determine the relative contribution of each item to a component by using the so-called "factor loadings," i.e., the weighting of the ith item to the jth component. These loadings are the correlations of the item (variable) with the component (factor). These weights are a measure of the degree of collinearity a given survey or background item has with other items in the factor. The factor loadings can range from ±1, and the relative contribution of the standardized variable[1] to the factor is indicated by the

[1]The factored data matrix consisted of the raw-data variables standardized to unit variance and zero mean. Since many of the data obtained from the survey instrument and background items are in different units, statistical standardization nondimensionalizes the original data matrix.

Table B.1

SAMPLE CORRELATION MATRIX: FACTOR 1 OF SURVEY DATA

		1 ENRPL	2 RPL	3 RCSP	4 CPATH	5 COMPY	6 COMTR	7 COMMB	8 COMHB	9 COMRB	10 COMJS	11 COMPF	12 CONSW
1.	ENRPL	1.00	0.40	0.02	0.15	0.10	0.11	0.04	0.04	0.12	0.04	0.05	0.08
2.	RPL		1.00	-0.07	0.17	0.20	0.31	0.25	0.20	0.21	0.11	0.33	0.44
3.	RCSP			1.00	0.04	0.07	0.26	0.06	0.12	0.09	0.04	0.15	0.31
4.	CPATH				1.00	0.04	0.12	0.07	0.09	0.04	0.05	0.08	0.11
5.	COMPY					1.00	0.09	0.17	0.00	0.17	0.14	0.15	0.17
6.	COMTR						1.00	0.17	0.27	0.17	0.10	0.13	0.40
7.	COMMB							1.00	0.16	0.31	0.08	0.11	0.21
8.	COMHB								1.00	0.21	0.09	0.09	0.17
9.	COMRB									1.00	0.21	0.06	0.18
10.	COMJS										1.00	-0.08	0.12
11.	COMPF											1.00	0.31
12.	COMSW												1.00

absolute value of the coefficient. Thus, using these weights helps one to determine which items or combinations of items "best" represent the suggested factor or construct in the data.

It is interesting to note that in Table B.2, the first component, which accounts for most of the variance in the survey data, is interpreted as reflecting reenlistment tendencies (RPL) and relative military and civilian job satisfaction (COMSW). These variables have the

Table B.2

SAMPLE PRINCIPAL-COMPONENTS ANALYSIS OF SURVEY DATA

Factor 1: Job satisfaction and reenlistment intent

Variable[a]	*Factor Loading*
Reenlistment intent (RPL)	-0.702
Reenlistment same specialty (RCSP)	-0.463
Supervisory career path (CPATH)	-0.284
Comparison of military and civilian employment	
Pay (COMPY)	-0.308
Training and job experiences (COMTR)	-0.557
Medical benefits (COMMB)	-0.400
Housing benefits (COMHB)	-0.373
Retirement benefits (COMRB)	-0.360
Job security (COMJS)	-0.220
Personal freedom (COMPF)	-0.430
Satisfying work (COMSW)	-0.675
Intend military service a career (ENRPL)	-0.369
Percent of the variance	10.4

[a]Variables with highest loadings and least missing data.

highest loading and are in the same direction (-0.702 and -0.675, respectively). The other variables that have the next highest loadings support this interpretation and measure relative general training and on-the-job experiences between civilian and military life (COMTR), and intent to reenlist in the same specialty (RCSP). As anticipated, correlated groupings existed in the background variables relating to length of service and paygrade, as well as to marital status, number

of dependents, and age (see Table B.3). There was also a high degree of correlation between aptitude and intelligence scores for this carefully screened group of airmen.

In some cases, it was judged that no information would be lost if a single variable was used to represent a factor formed by a set of interdependent items. This conclusion was reached based on the painstaking comparisons of the magnitude of the simple correlations, coefficients of the factor loadings, the percentage of the variance that the factor accounted for, the level of significance of the chi-square statistic associated with the cross-tabulations, and the sensitivity of the factors regression coefficient in subsequent analyses. With other groups of items, it was decided that the measurement error would be significantly reduced by a composite index of several items to represent a construct in the data. A number of variables had to

Table B.3

SAMPLE PRINCIPAL-COMPONENTS ANALYSIS OF BACKGROUND DATA

Variable	*Factor Loading*
Factor 1: Marital condition	
Length of service (months) (LOS)	0.685
Marital status (WED)	0.500
Number of dependents (DEPS)	0.495
Pay grade (PG)	0.625
Age (years)	0.516
Percent of variance	18.8
Factor 2: Aptitude/intelligence	
AFQT percentile (AFQT)	-0.475
General aptitude (GAPT)	-0.434
Mechanical aptitude (MAPT)	-0.651
Clerical aptitude (CAPT)	-0.616
Electrical aptitude (EAPT)	-0.548
Percent of variance	14.2

be excluded because of severe missing-data problems, which resulted either from lack of a response or from questions that were not applicable.[2] The final selection of variables (composite and individual) is presented in Appendix C.

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[2]Examples of missing-data problems were found with survey items such as civilian pay before entering the Air Force and expected civilian pay upon leaving the Air Force.

Appendix C

DESCRIPTION OF THE EXPLANATORY VARIABLES

EXPLANATORY VARIABLES FOR AVIONICS TECHNICIANS' REENLISTMENT INTENTIONS

1. JOBSAT: Relative Job Satisfaction Index
   (Mean = 1.632; S.D. = 0.974)

   JOBSAT = (COMTR + COMPF + COMSW)/3

			Civilian Better	No Difference	Military Better
COMTR	Training and Job Experience	=	1	2	3
COMPF	Personal Freedom	=	1	2	3
COMSW	Satisfying Work	=	1	2	3

2. ENRPL: Intend Military Service a Career at Enlistment
   (Mean = 2.241; S.D. = 0.475)

   $$\text{ENRPL} = \begin{cases} 1 & \text{No} \\ 2 & \text{Undecided, but probably No} \\ 3 & \text{Undecided, but probably Yes} \\ 4 & \text{Yes} \end{cases}$$

3. FRINGB: Relative Fringe Benefit Index
   (Mean = 2.592; S.D. = 0.475)

   FRINGB = (COMRB + COMHB + COMMB)/3

			Civilian Better	No Difference	Military Better
COMRB	Retirement Benefits	=	1	2	3
COMHB	Housing Benefits	=	1	2	3
COMMB	Medical Benefits	=	1	2	3

4. WED: Marital Status
   (Mean = 0.313; S.D. = N.A.)

   $$\text{WED} = \begin{cases} 1 & \text{If married} \\ 0 & \text{Otherwise} \end{cases}$$

5. MILPY: Relative Pay
   (Mean = 1.349; S.D. = N.A.)

   $$\text{MILPY} = \begin{cases} 1 & \text{Civilian pay better} \\ 2 & \text{No difference} \\ 3 & \text{Military pay better} \end{cases}$$

6. MAS: Length of Service at Duty Station (Months)
(Mean = 7.405; S.D. = 3.593)

7. CPATH: Career Path (if pay for both would be the same)
(Mean = 0.482; S.D. = N.A.)

$$\text{CPATH} = \begin{cases} 0 & \text{Work in specialty (but not supervise others)} \\ 1 & \text{Become a supervisor} \end{cases}$$

Table C.1

NAVY REENLISTMENT INTENTION FACTORS AND THEIR QUESTIONNAIRE ITEMS

(Sample of 3115 Navy enlisted personnel)

	Factor Loading
Factor 1: SATISFACTION WITH THE NAVY	
General Job Attitude (GJA)	.68
Morale	.68
Duty Station	.62
Habitability	.51
Handling of Complaints/Requests	.49
Navy Career--Satisfactory	.49
Factor 2: SENIORITY/PERFORMANCE	
Age (Years)	.69
Paygrade	.57
Years of Active Duty	.56
Professional Performance, Self-Rating	.48
Professional Performance, Peer-Comparison	.45
Months to End of Active Term of Service	-.59
Factor 3: TRAINING	
A-School	.65
Received School Training for Duties Assigned	.61
C-School	.51
Use School Training	.47
Choose Rating	.41
Factor 4: ENLISTMENT MOTIVATION	
Joined for Job Security	.61
Joined for Training	.58
Joined for Job Opportunities	.57
Joined for Travel	.54
Draft-Motivated/Volunteer	.50
Joined for Tradition	.39
Factor 5: MARITAL CHARACTERISTICS	
Marital Status	.75
Dependent Children	.61
Wife or Girlfriend Nearby	.50
Monthly Earnings after Taxes	.48
Factor 6: SOCIOECONOMIC CHARACTERISTICS	
Standard of Living	.54
Area of Town	.53
Bedroom of Own	.53
Schooling--Father	.48
Educational Attainment	.41
Number of Siblings	-.53

SOURCE: Peter H. Stoloff et al., *An Analysis of First-Term Reenlistment Intentions*, CRC-232, Center for Naval Analyses, November 1972, Table 45, p. 55.

Appendix D

DISCRIMINANT CLASSIFICATION ANALYSIS AND MEANS OF DISCRIMINANT VARIABLES

THE DISCRIMINANT CLASSIFICATION ANALYSIS

Proportional Chance Model

Letting

$$P_i = \text{"true" proportion in Group } i \text{ ,} \qquad (D.1)$$
$$\alpha_i = \text{proportion classified as Group } i \text{ ,} \quad i = 1, 2, \ldots, g \text{ ,}$$

then the proportional chance probability of an individual being classified correctly, P_c, is

$$P_c = \sum_{i=1}^{g} P_i \alpha_i \text{ ,} \qquad (D.2)$$

where, for this study,

$$g = 4 \qquad (D.3)$$

and

$$P_1 = 0.410 \text{ or } (172/420) \text{ ,}$$
$$P_2 = 0.250 \text{ or } (105/420) \text{ ,}$$
$$P_3 = 0.276 \text{ or } (116/420) \text{ ,}$$
$$P_4 = 0.064 \text{ or } (27/420) \text{ .}$$

Maximum Chance Model

The maximum chance probability model is given by

$$Pmax = \max (P_i) \text{ ,} \quad i = 1, 2, \ldots, g \text{ .} \qquad (D.4)$$

The largest "true" proportion in the g groups is Pmax, i.e.,

$$Pmax = P_1 = 0.410 \ . \qquad (D.5)$$

Table D.1

MEANS OF DISCRIMINANT VARIABLES

Variable	Means for Four Response Groups				Total Sample Mean
	(1) No	(2) Undecided No	(3) Undecided Yes	(4) Yes	
JOBSAT	1.382	1.673	1.842	2.173	1.632
ENRPL	1.758	2.177	2.791	3.200	2.241
FRINGB	2.416	2.660	2.736	2.827	2.592
WED	0.1911	0.271	0.436	0.6800	0.313
MILPY	1.229	1.219	1.536	1.800	1.349
MAS	8.070	6.938	6.627	8.600	7.405
CPATH	0.369	0.438	0.682	0.520	0.482
Sample size	159	96	110	25	390

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